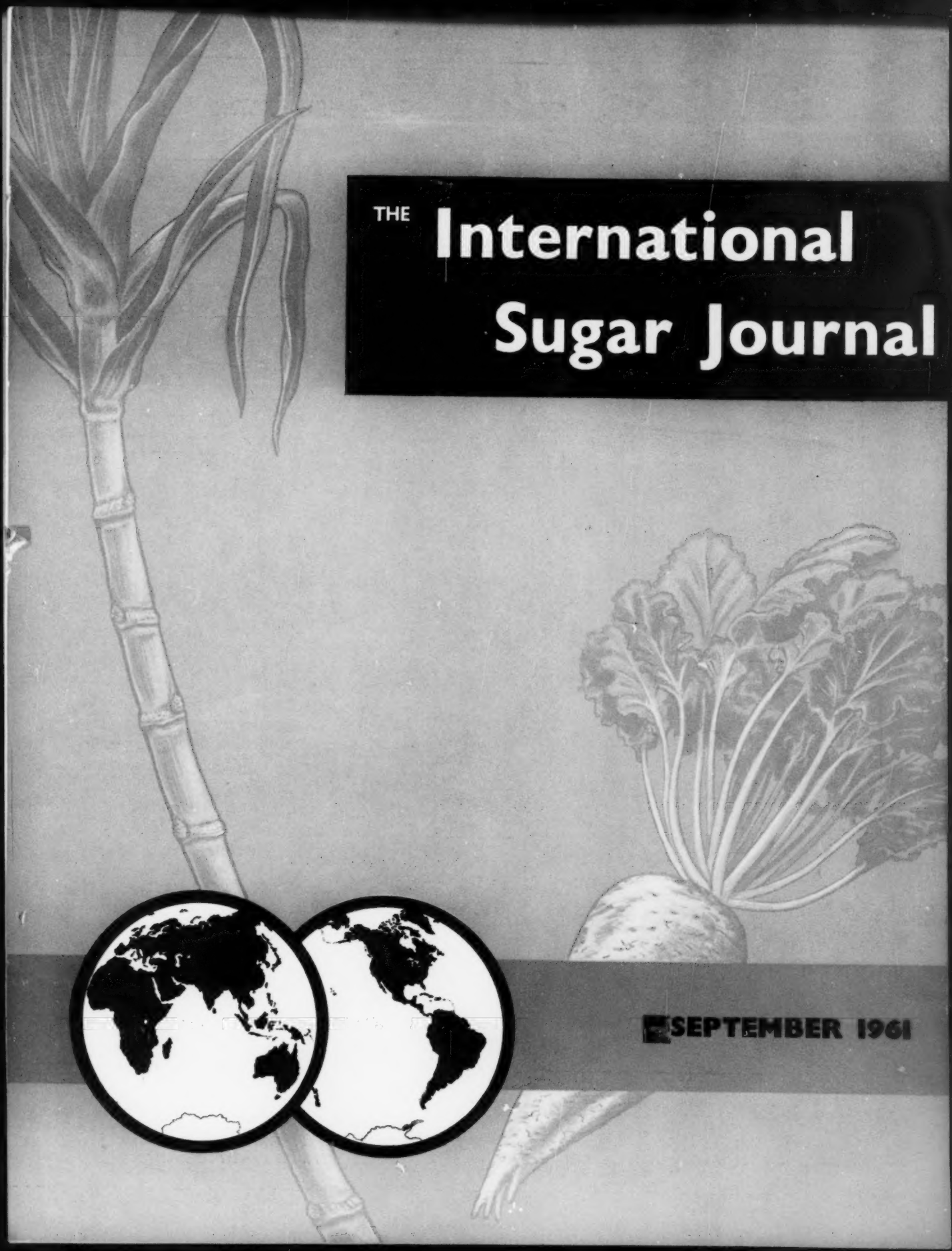
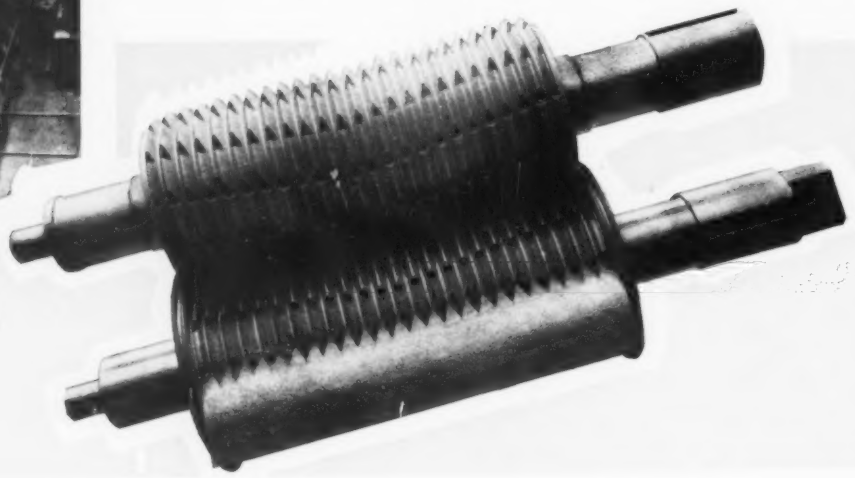

THE International Sugar Journal
SEPTEMBER 1961

RELENTLESS on the toughest cane

Mirrlees

SUGAR MILL ROLLERS

THE UNRIVALLED QUALITY OF MIRRLEES ROLLERS IS ACHIEVED BY CAREFUL ATTENTION TO DETAIL



Recorded chemical analysis and hardness checked against performance ensure a Roller with a shell of strong, durable coarse material.

The "Double Grip" feature of Mirrlees shells is particularly advantageous when dealing with mechanically loaded cane in high speed mills.

Section showing milling plant of central Rio Haina, Dominican Republic, supplied by Mirrlees and grinding 6,900 tons cane per day, and two Mirrlees Chevron grooved rollers.

THE MIRRLEES WATSON COMPANY LIMITED

HEAD OFFICE AND WORKS : 45 SCOTLAND STREET, GLASGOW, SCOTLAND TELEGRAMS : "MIRRLEES GLASGOW"
LONDON OFFICE : 38 GROSVENOR GARDENS, S.W.1. CABLES : "MIRRLEES SOWEST LONDON"

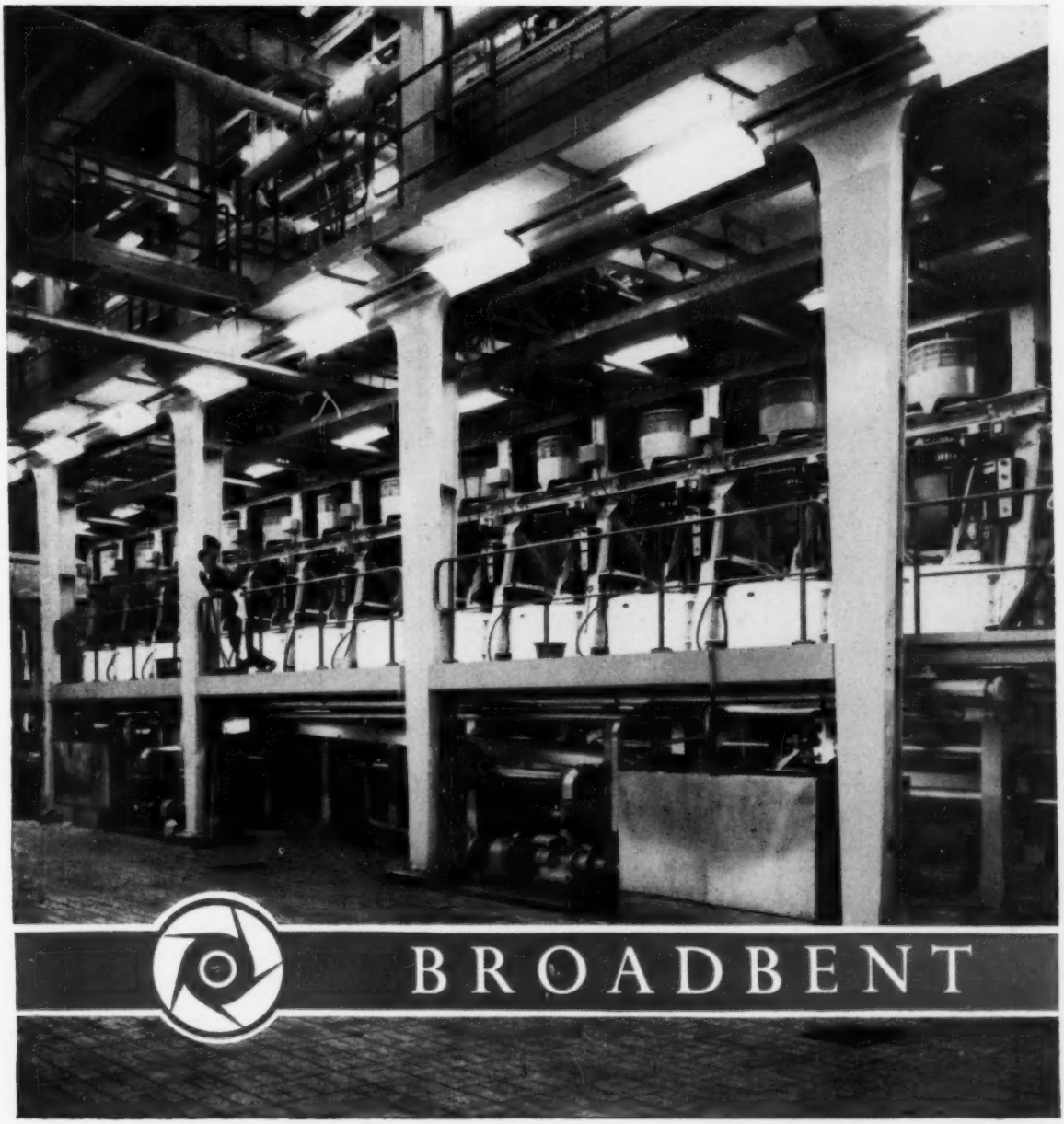
A battery of twelve 48″ × 30″ R.P.M. synchronous centrifugals installed in 1960 at the Friesch-Groningsche sugar factory, Holland.

We recently had the pleasure of receiving a further order for twelve 48″ automatic centrifugals for the white sugar production.

THOMAS BROADBENT & SONS LTD.

CENTRAL IRONWORKS :: HUDDERSFIELD, ENGLAND

TELEPHONE: 5520–5. TELEGRAMS: "BROADBENT", HUDDERSFIELD

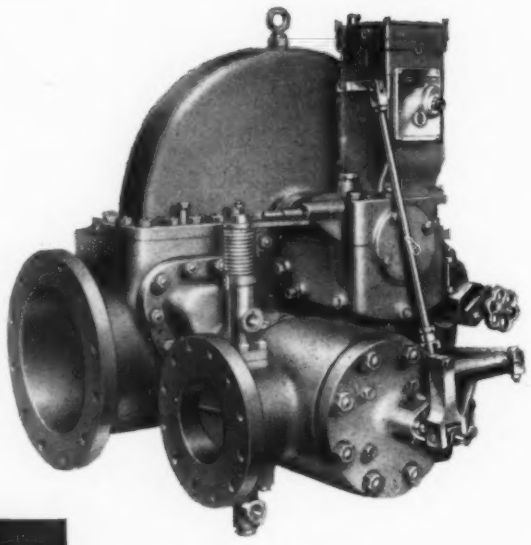


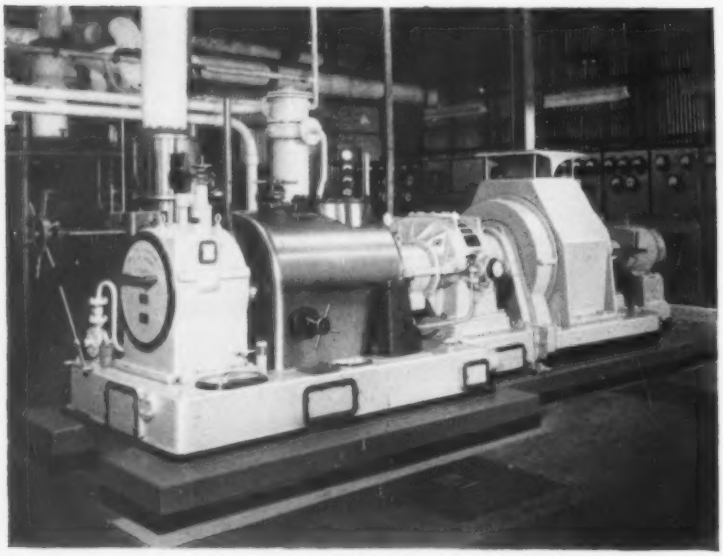
THE B & M SINGLE STAGE
SUGAR MILL TURBINE

Simple in design
Reliable and Economical
in Operation

25 to 1,200 h.p. direct coupled at speeds of up to 5,000 r.p.m. max. or supplied with reduction gearing of any desired ratio.

'B & M' single stage variable speed mechanical drive turbine, particularly adapted for SUGAR MILLS, PUMPS, etc.





750 kw back pressure turbine installed at Farleigh Sugar Mill, Queensland.

1,500 kw 'B & M' back pressure turbine and several steam engines also installed.

Many hundreds of 'B & M' Steam Turbines and Steam Engines have been supplied to the Sugar Industry for electrical and mechanical drives for:

CRUSHERS
MILLS
CANE KNIVES
PUMPS ETC.

Also **VACUUM PUMPS** Reciprocating and Rotary types.
'ARCA' Pressure and Temperature REGULATORS

With the considerable resources of our up to date factory available, we are always interested in receiving enquiries for the manufacture of machinery to YOUR OWN DESIGNS.

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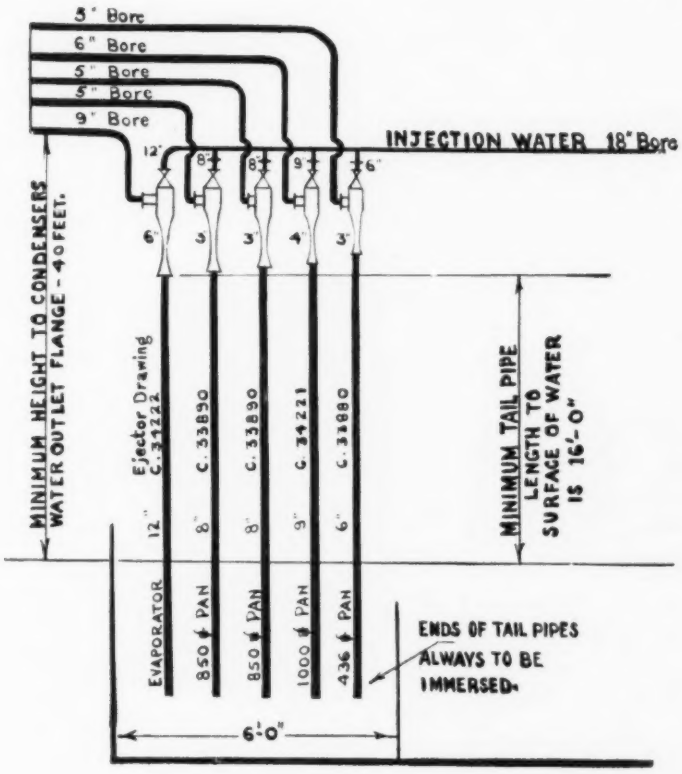
Belliss & Morcom Ltd

London Office:
25, Victoria Street, S.W.1.

BIRMINGHAM 16 · ENGLAND

The AIR PUMPS

are



Diagramatic arrangement of Water Operated
Air Pumps recently supplied to the Miwani Sugar Factory.

THE MIRRLEES WATSON COMPANY LIMITED

GLASGOW :: :: SCOTLAND

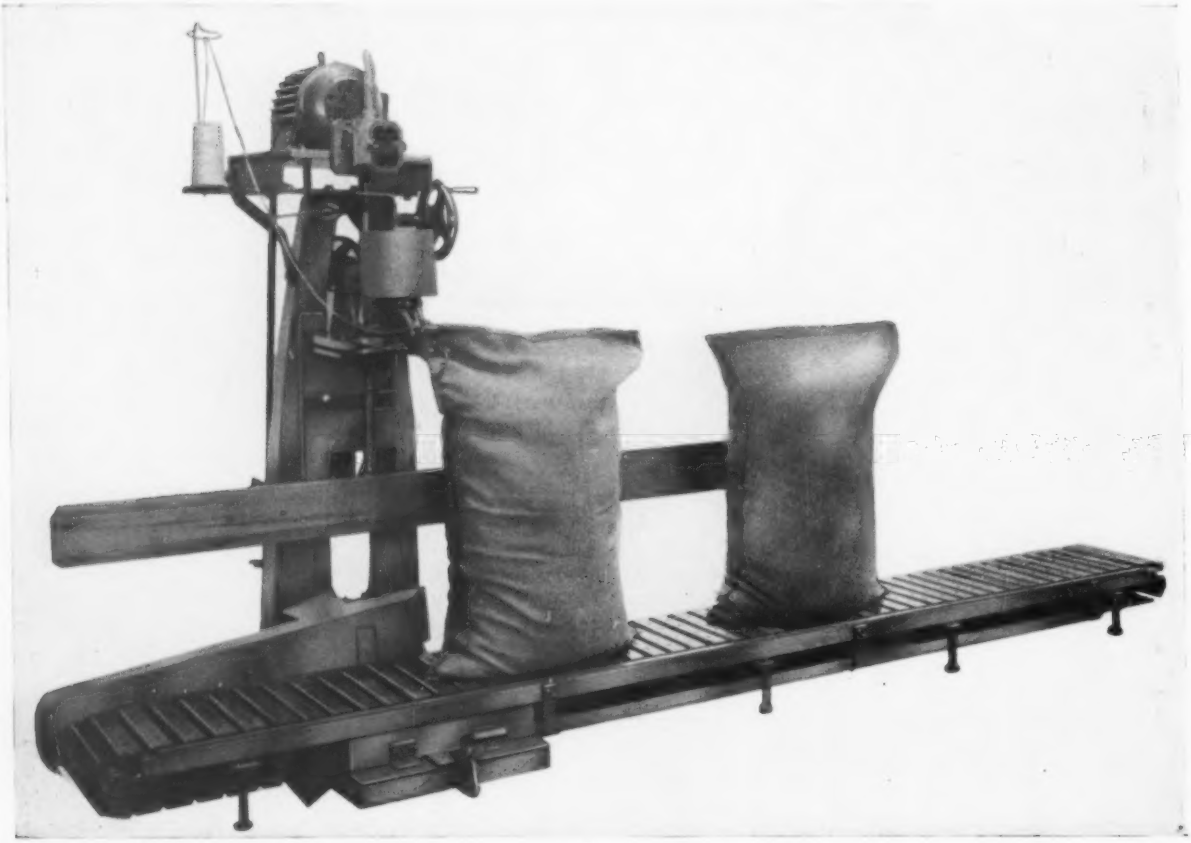
Telegrams : "MIRRLEES, GLASGOW"

London Office : 38, GROSVENOR GARDENS. *Telegrams :* "MIRRLEES, SOWEST, LONDON"

The 'Super' Universal Sack Closing Machine

MODEL NO. 5B

Fitted with 10 or 12 ft. Conveyor and Special Clutch Drive



This machine is fitted with a conveyor 10 or 12 ft. overall and a Special Clutch Drive which allows the conveyor to be run independently of the sewing head.

Jute, Hessian, Paper Lined Hessian, Cotton and Paper Sacks weighing from 50 to 325 lbs. can be sewn on this machine.

Machines can be seen working by appointment.

Power required 2 *h.p.* *Shipping weight :* 14 *cwts.*

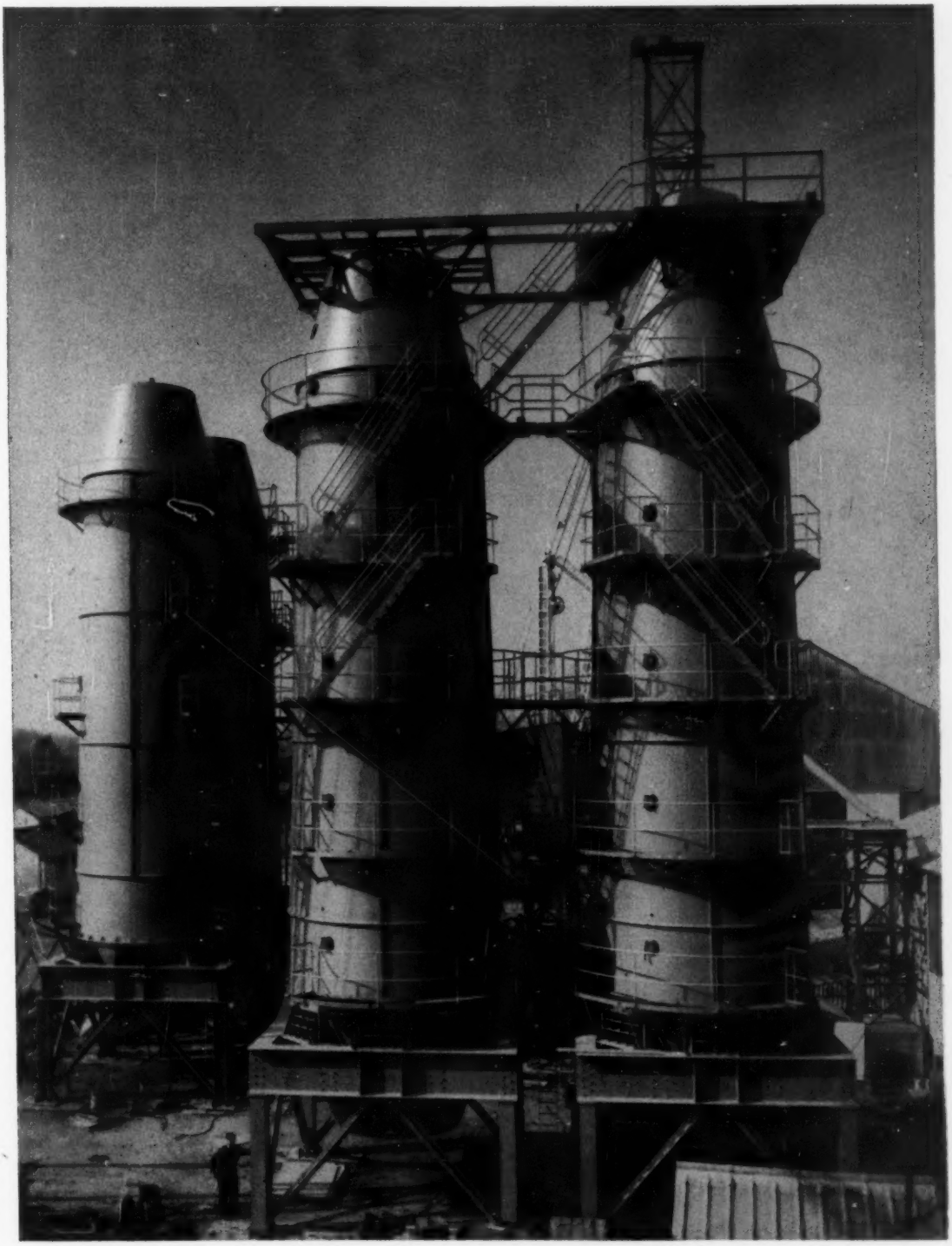
Manufactured in Great Britain by :

The Sack Filling & Sewing Machine Syndicate Limited

(Timewell's Patent)

TIMEWELL WORKS · LOCKFIELD AVENUE · BRIMSDOWN · ENFIELD . MIDDX.

Telephone : HOWARD 1188 *Telegrams :* FECIT, ENFIELD



4—140 Cu.m. LIME KILNS

prior to Shipment

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Telephone : Ipswich 56161 (6 *lines*) **IPSWICH, ENGLAND.** *Telegrams :* } *Cocksedge, Ipswich.*
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TATE & LYLE
Choose ROTARY LOUVRE

One of Dunford & Elliott's latest and largest achievements for sugar refineries is the installation of four completely automatic Rotary Louvre Dryers and ancillary equipment at the THAMES REFINERY of TATE & LYLE LTD.—believed to be the biggest refinery in the world.

Control panel for Rotary Louvre sugar drying installation at the new Tate & Lyle Thames Refinery, designed and supplied by Dunford & Elliott. Photo by courtesy of Tate & Lyle Ltd.

DUNFORD & ELLIOTT
PROCESS ENGINEERING LTD.
Engineering of complete processes
DRYERS · COOLERS
ROASTERS

LINDARS AUTOMATION LTD.
AUTOMATION ENGINEERING

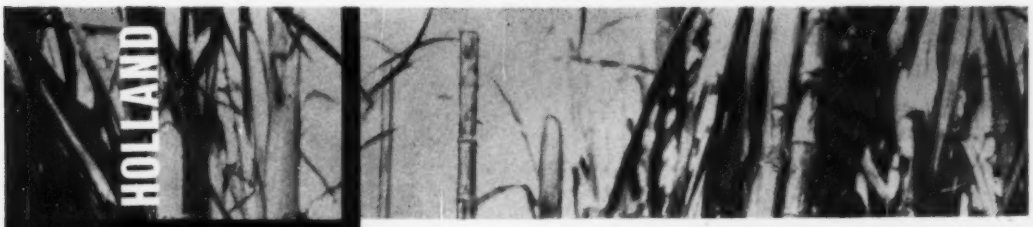
THERMIX INDUSTRIES LTD.
DUST CONTROL AND COLLECTION EQUIPMENT

DUNFORD & ELLIOTT
ENGINEERING GROUP

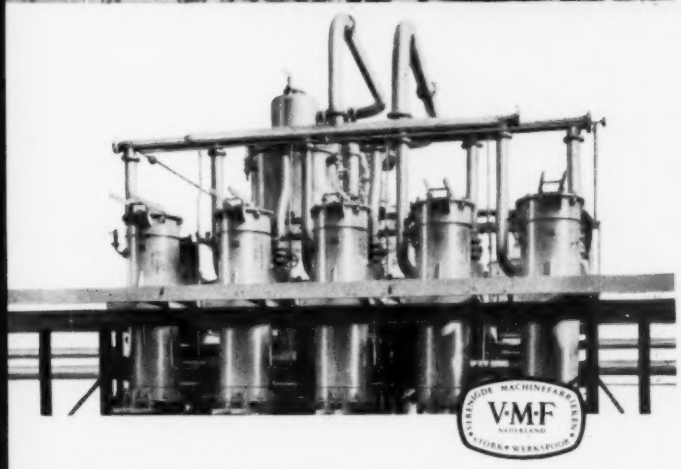
Dunford & Elliott are also proud to announce having received an order to supply *Rotary Louvre* Sugar Drying and Cooling installations through Messrs. Vickers & Bookers Ltd. to two factories in the U.S.S.R.

Rotary Louvre Dryers and Coolers are used in leading industries throughout the world—as well as in the sugar industry—and frequently form part of such giant industrial projects as *Durgapur* in India.

Headquarters: 143 Maple Road, Surbiton, Surrey
Telephone: Kingston 7799
Telegrams: Lindaresco, Telex, London.



One manufacturer for your complete sugar factory:



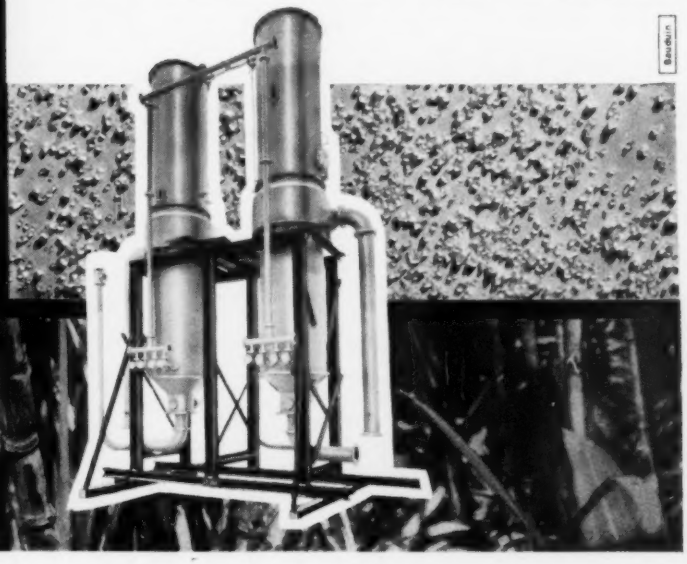
STORK-WERKSPOOR

JUICE PROCESSING:

Vertical preheaters with multi-pass circulation, made of steel plate, electrically welded throughout and equipped with brass tubes, expanded into the tube plates, erected with external piping before despatch.

Tanks. Carbonation and sulphitation tanks of batch and continuous process type.

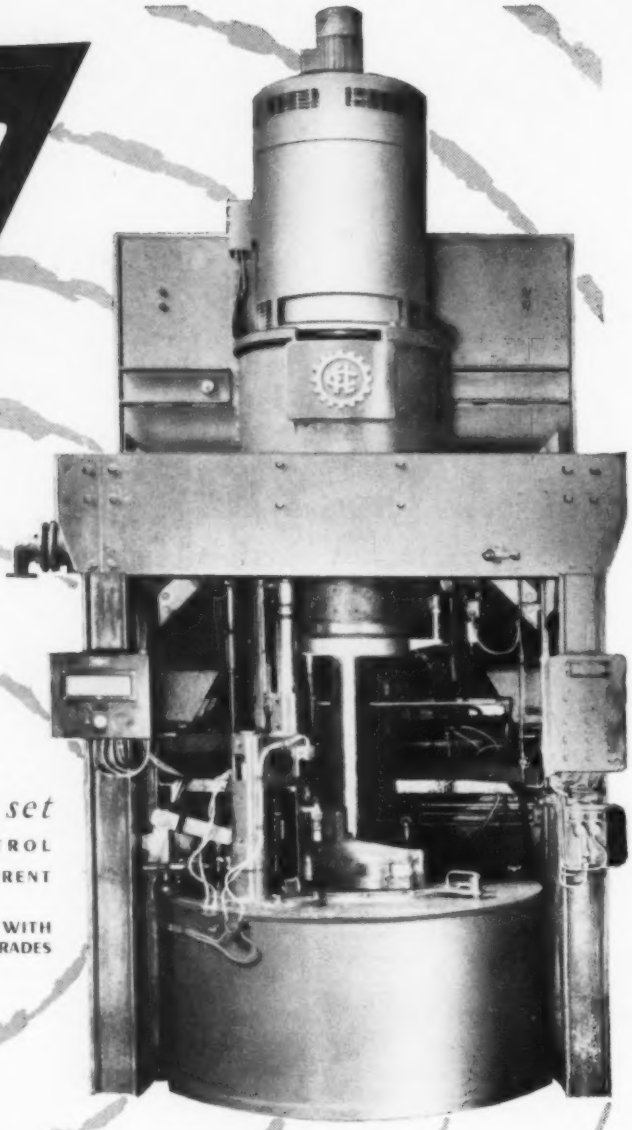
For all sugar machinery apply to STORK - Hengelo - Holland.



Fully automatic!

the new

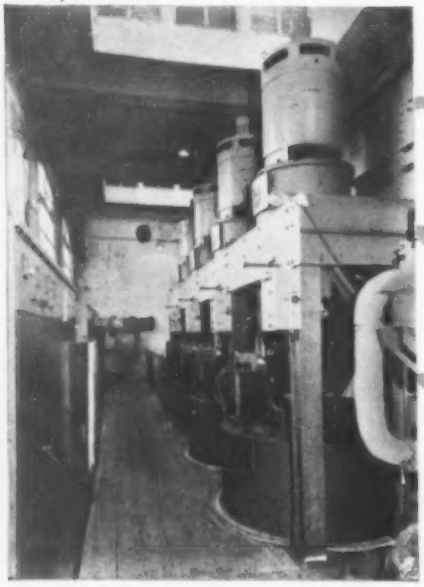
CENTRIFUGAL



driven by
WARD-LEONARD *set*

- ELECTRONIC CONTROL
- ELIMINATION OF CURRENT PEAKS
- RECORD PRODUCTION WITH MASSECUITES OF ALL GRADES

Battery of 4 centrifugals at the Fontaine-le-Dun Sugar Factory (France)



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Under a single comprehensive contract, with undivided responsibility, 'ENGLISH ELECTRIC' undertake complete factory electrification.

DIESEL ALTERNATOR SETS
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TRANSFORMERS · SWITCHGEAR
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THE ENGLISH ELECTRIC COMPANY LIMITED, ENGLISH ELECTRIC HOUSE, STRAND, LONDON, W.C.2
Electrical Plant Division, Stafford
WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

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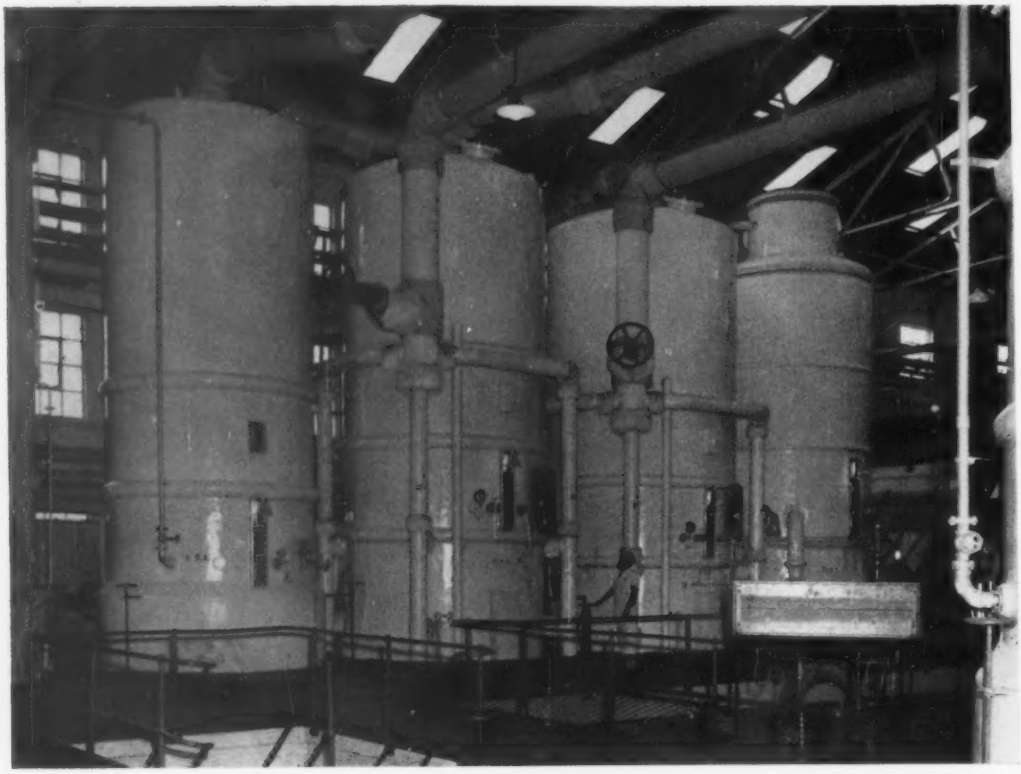


Evaporators at the British Sugar Corporation Beet Sugar Factory at Cupar fitted with H & W 70/30 Brass Tubes. The evaporators are lagged with plastic lagging. (Photograph by courtesy of the British Sugar Corporation Limited).

H&W

BRASS TUBES

for

JUICE HEATERS

EVAPORATORS

VACUUM PANS

for quality uniformity and dependability

HUDSON & WRIGHT LTD. HALBERTON STREET, BIRMINGHAM 18

50, WELLINGTON STREET, GLASGOW, C.2.

One sole full-automatic

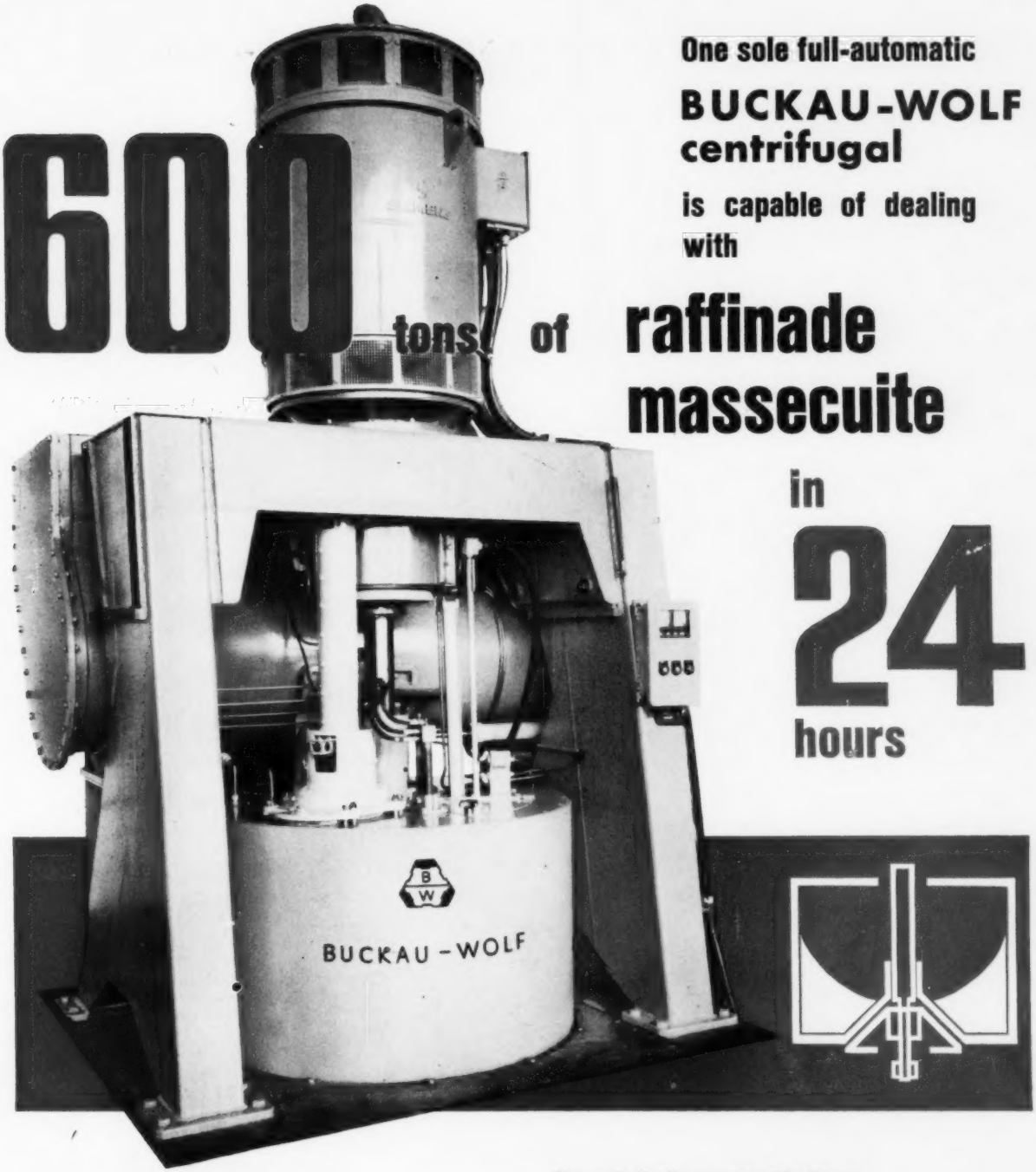
BUCKAU-WOLF centrifugal

is capable of dealing with

600 tons of raffinade massecuite

in

24 hours



Special characteristics:

Bottom valve,
travelling washing nozzle,
pressure accumulators

MASCHINENFABRIK BUCKAU R. WOLF

AKTIENGESELLSCHAFT · GREVENBROICH - NEUSS - KIEL

(WESTERN GERMANY)

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COMPLETE ALCOHOL PLANTS

by APV

APV have been responsible for the development, design, construction and commissioning of complete alcohol plants all over the world. They have the experience, resources and organisation to deal with complete projects for the production of all types of alcohol from molasses, as well as from dates, rice, grain and other raw materials.

Alcohol projects undertaken by APV in recent years include the following:—

EAST INDIA DISTILLERIES LTD., INDIA.
900,000 galls./year of rectified spirit from molasses.

BURMA PHARMACEUTICAL INDUSTRY, BURMA.
750,000 galls./year of alcohol and 330,000 lb./year of dried medicinal yeast from rice.

COLONIAL SUGAR RECTIFYING CO., AUSTRALIA.
2,100,000 galls./year of absolute alcohol or rectified spirit.

MODERN CHEMICAL INDUSTRIES LTD., IRAQ.
360,000 galls./year of rectified spirit from dates.

SUGAR MANUFACTURERS' ASSOCIATION, JAMAICA
2,100,000 galls./year of absolute alcohol from rum.

MACNAB DISTILLERIES LTD., SCOTLAND.
360,000 galls./year of grain whisky.

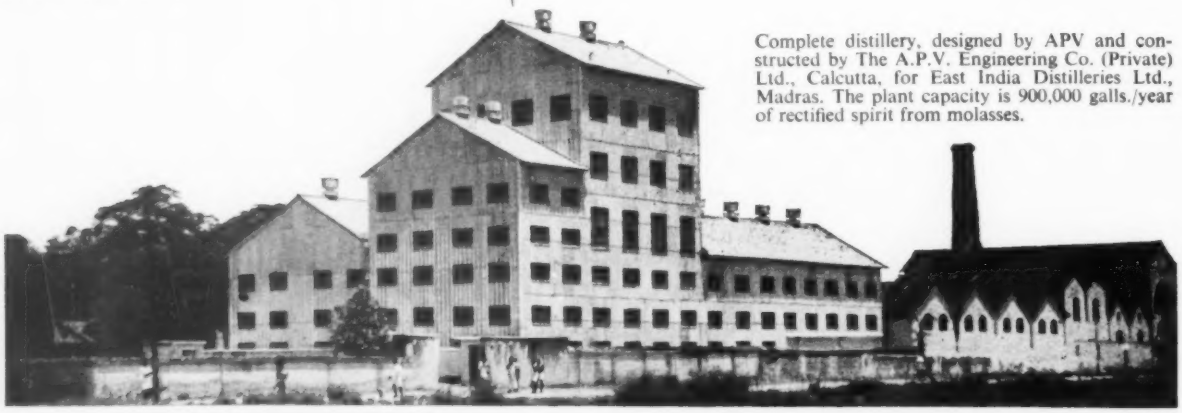
PREMIER SUGAR MILLS, PAKISTAN.
Fermentation plant for 600,000 galls./year distillery.

DYER-NEAKIN LTD., INDIA.
360,000 galls./year of high quality potable rectified spirit from molasses.

WRAY & NEPHEW LTD., JAMAICA.
180,000 galls./year of gin spirit from molasses.

S. A. DAVSON & CO. LTD., BRITISH GUIANA.
360,000 galls./year of rum from molasses wash.

BEN NEVIS DISTILLERY LTD., SCOTLAND.
180,000 galls./year of grain whisky.



Complete distillery, designed by APV and constructed by The A.P.V. Engineering Co. (Private) Ltd., Calcutta, for East India Distilleries Ltd., Madras. The plant capacity is 900,000 galls./year of rectified spirit from molasses.

APV **CHEMICAL ENGINEERING DIVISION**

Contractors and engineers to the fermentation and alcohol distillation industries. Plants for grain cooking, saccharification, yeast culture, fermentation, CO_2 recovery, etc. Stills and other equipment for the manufacture of all types of alcohol including whisky, gin and rum.

THE A.P.V. COMPANY LIMITED · MANOR ROYAL · CRAWLEY · SUSSEX

TELEPHONE: CRAWLEY 1360. TELEX: 8737. TELEGRAMS: ANACLASTIC, CRAWLEY

Objective Consulting and Conscientious supervision of execution of projects all along the line of SUGAR will improve

PERFORMANCE
ECONOMY
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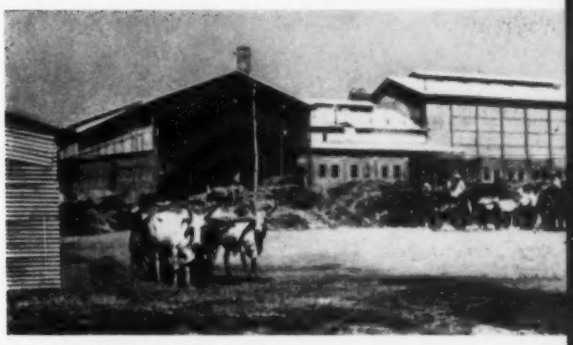
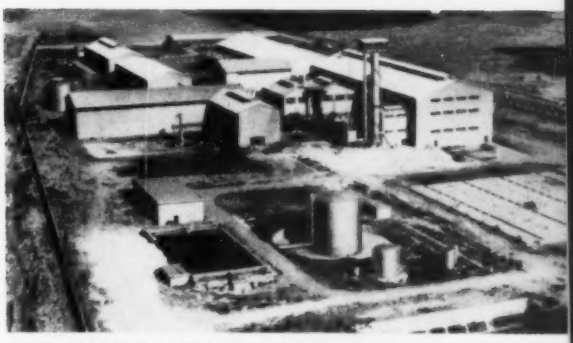
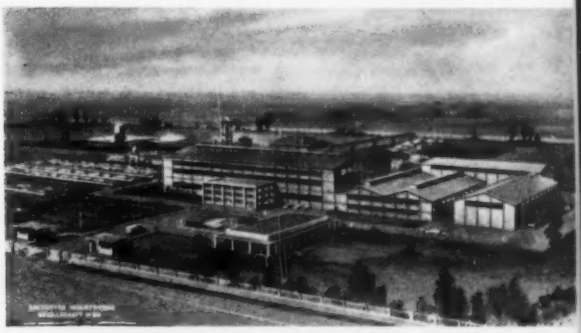


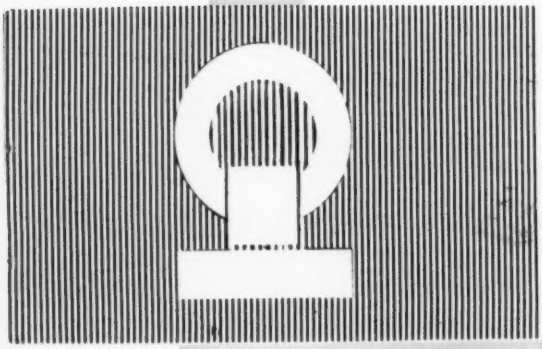
CANE SUGAR PLANT INDIA



BEET SUGAR PLANT AND REFINERY IRAQ



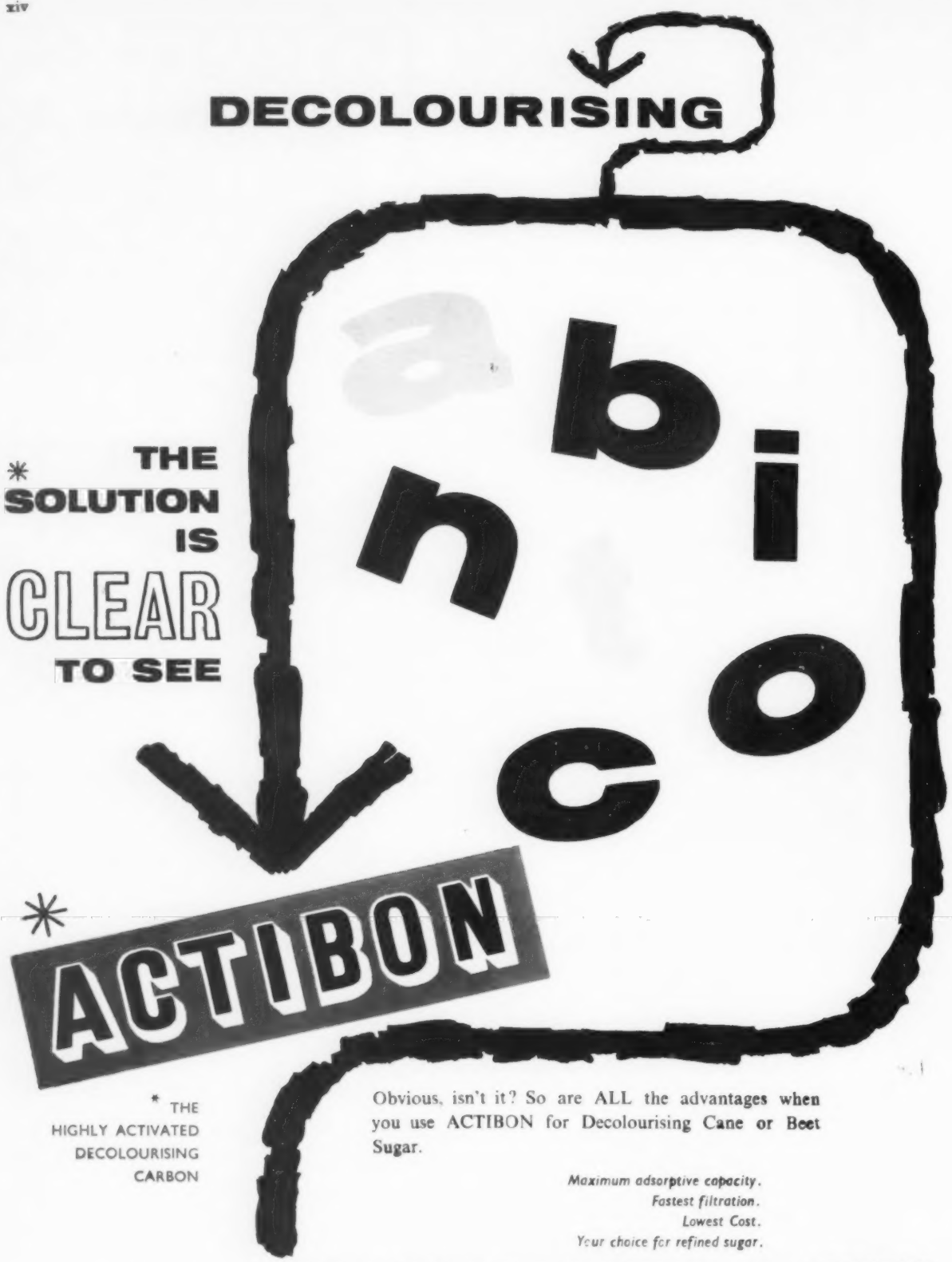
BEET SUGAR PLANT AND REFINERY IRAN



SALZGITTER INDUSTRIEBAU GMBH

SALZGITTER-DRÜTTE

DECOLOURISING



* THE HIGHLY ACTIVATED DECOLOURISING CARBON

Obvious, isn't it? So are ALL the advantages when you use ACTIBON for Decolourising Cane or Beet Sugar.

Maximum adsorptive capacity.
Fastest filtration.
Lowest Cost.
Your choice for refined sugar.

THE CLYDESDALE CHEMICAL CO., LIMITED

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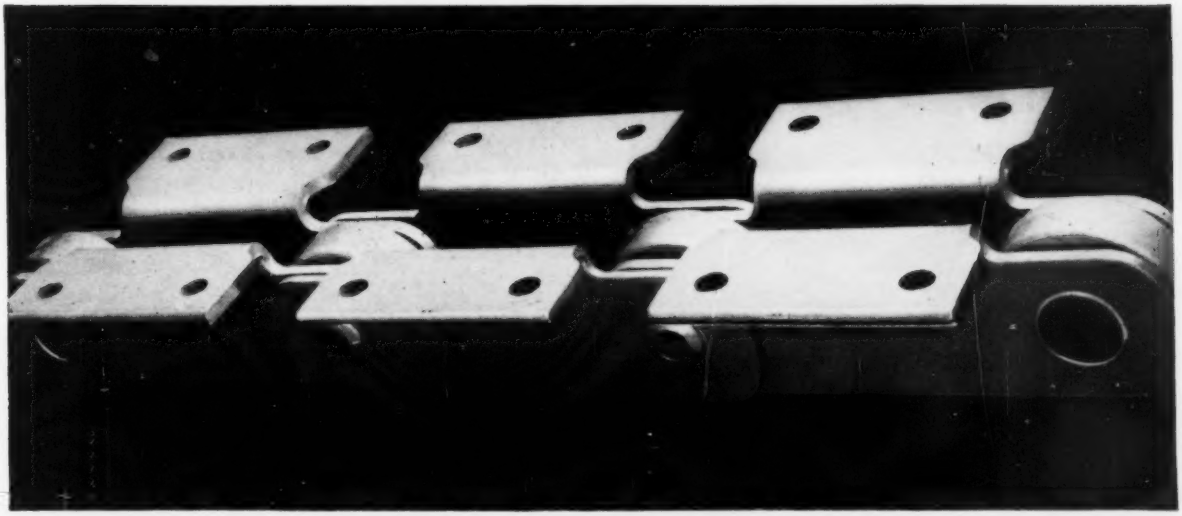
These are our strong points –

- Hardened rollers
- Up to 100,000 lb. breaking load
- 20% more bearing area
- Riveted or detachable
- Provision for grease-gun lubrication as required
- Specially designed heavy gauge side plates with integral attachments



RENOLD CANE CONDUCTOR CHAINS

These Renold conveyor chains are designed and manufactured for heavy and arduous duties in the cane sugar industry. They offer the attractive combination of high strength and low price and are outstanding in providing 20% more bearing area than most competitive makes. All chains have hardened rollers which ensure increased life and consequently reduced cost per year of service. They are usually supplied rivetted with connecting links at 10 foot intervals but detachable chains can also be supplied.

RENOLD

RENOLD CHAINS LIMITED · MANCHESTER

The Crystalloscope is an instrument designed for controlling and improving the process of sugar boiling. It also finds application in some fields of the pharmaceutical and chemical industries.

The Crystalloscope revolutionizes the conventional process of sugar boiling by dispensing with the use of sampler tap, and increasing the economy of sugar production by 15%.

The high efficiency involved in its use makes the Crystalloscope suitable for checking the process of preparing primary, intermediate and final products as well as refinements.

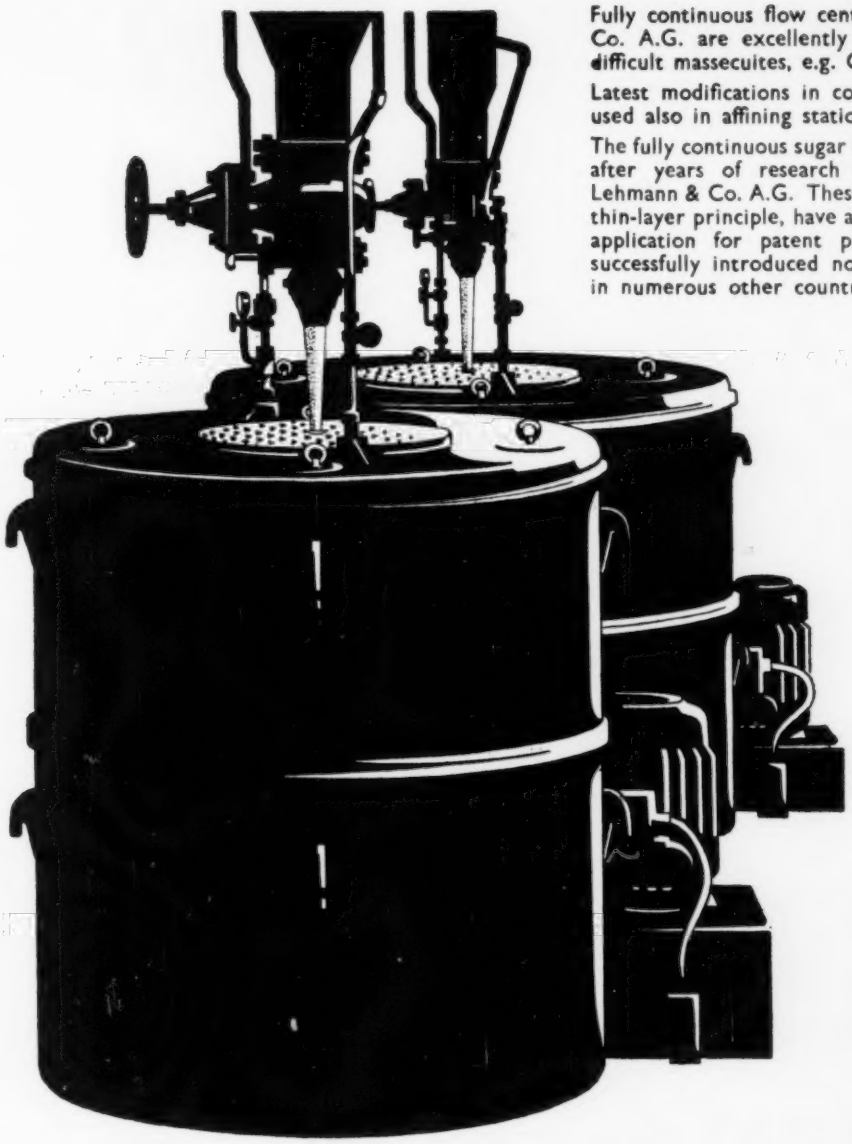
Exporters:

METRIMPEX

HUNGARIAN TRADING COMPANY FOR INSTRUMENTS

Letters: Budapest 62, POB 202, Hungary.

Telegrams: INSTRUMENT BUDAPEST



Fully continuous flow centrifugals of Hein, Lehmann & Co. A.G. are excellently suitable for curing of most difficult massecuites, e.g. C-, final or second product.

Latest modifications in construction allow them to be used also in affining stations.

The fully continuous sugar centrifugal has been perfected after years of research and development by Hein, Lehmann & Co. A.G. These centrifugals, working on the thin-layer principle, have already been copied in spite of application for patent protection. They have been successfully introduced not only in Germany but also in numerous other countries.

Fully Continuous Flow Centrifugals

offer the following advantages:

- continuous working
- reduction of working personnel
- small current consumption, no current peaks
- high output
- light weight
- no special foundations
- vibration-free running
- uniform sugar quality

HEIN, LEHMANN & CO.

Aktiengesellschaft Duesseldorf

Abt. Massentrennung

Telephone: 70201 *Telex:* 0858 2740 P.O. Box 4109

the experience of years!

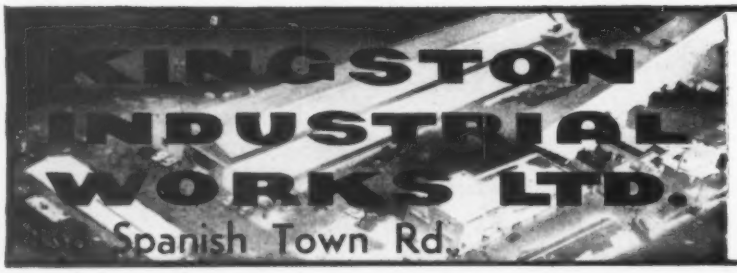
K.I.W.

uses their years of experience in making

SUGAR ROLLERS

MANUFACTURED AND RE-CAST
UNDER EXPERT SUPERVISION
TRIPLE CHECKING SYSTEM

OPEN GRAIN—EVEN WEAR
HIGHEST GRADE STEEL SHAFTS
MOST COMPETITIVE PRICES



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SUGAR HANDLING PLANT by

NEWCON

Manufacturers of all types of
RAW, WHITE and BEET PLANTS.
EQUIPMENT INSTALLED
IN ANY PART OF THE WORLD

NEW CONVEYOR COMPANY LIMITED

A COMPANY

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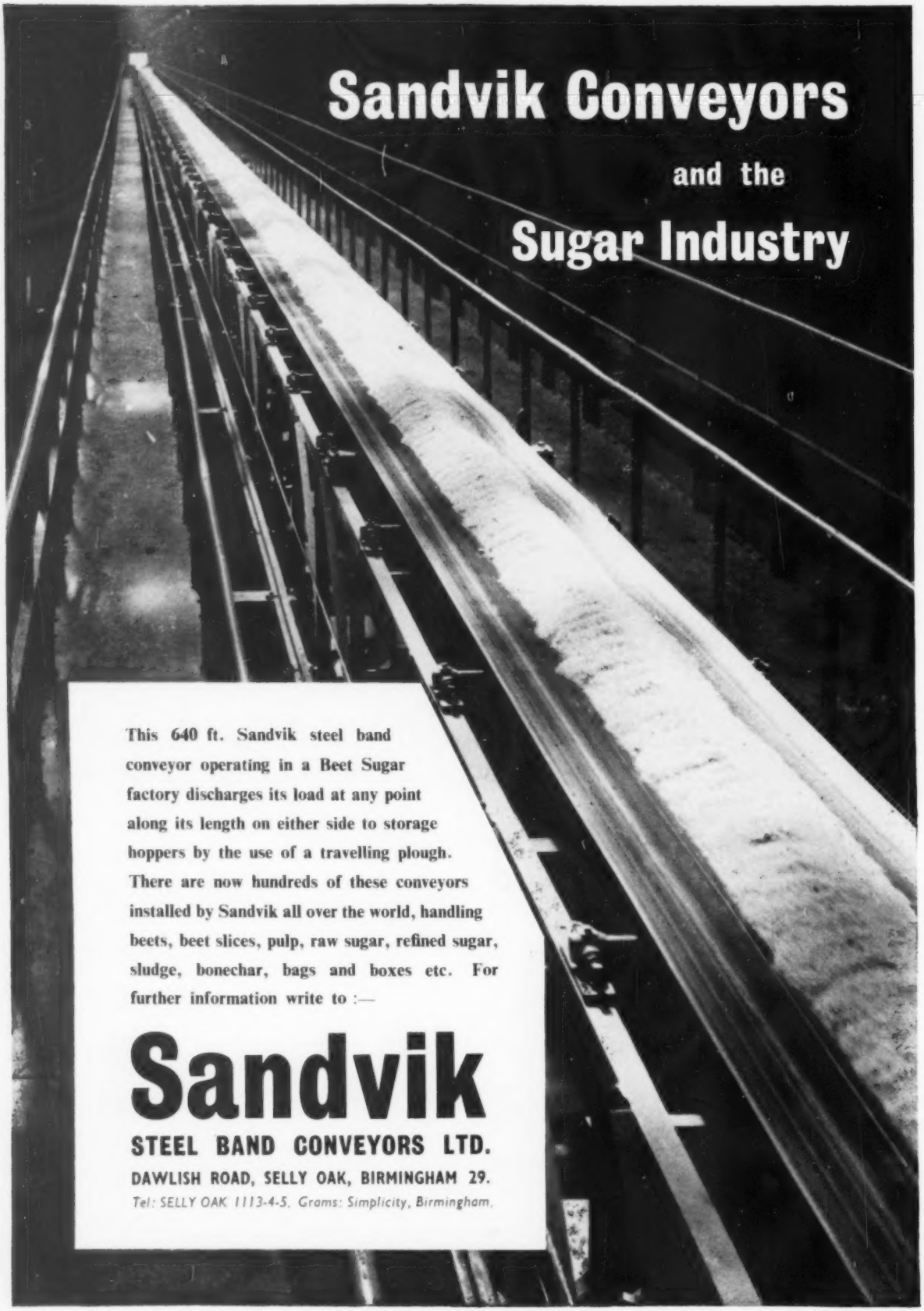
AGENTS IN: ARGENTINA, AUSTRALIA, BELGIUM, INDIA, PAKISTAN, WEST INDIES, SOUTH AFRICA, TURKEY, U.S.A. AND MANY OTHER COUNTRIES



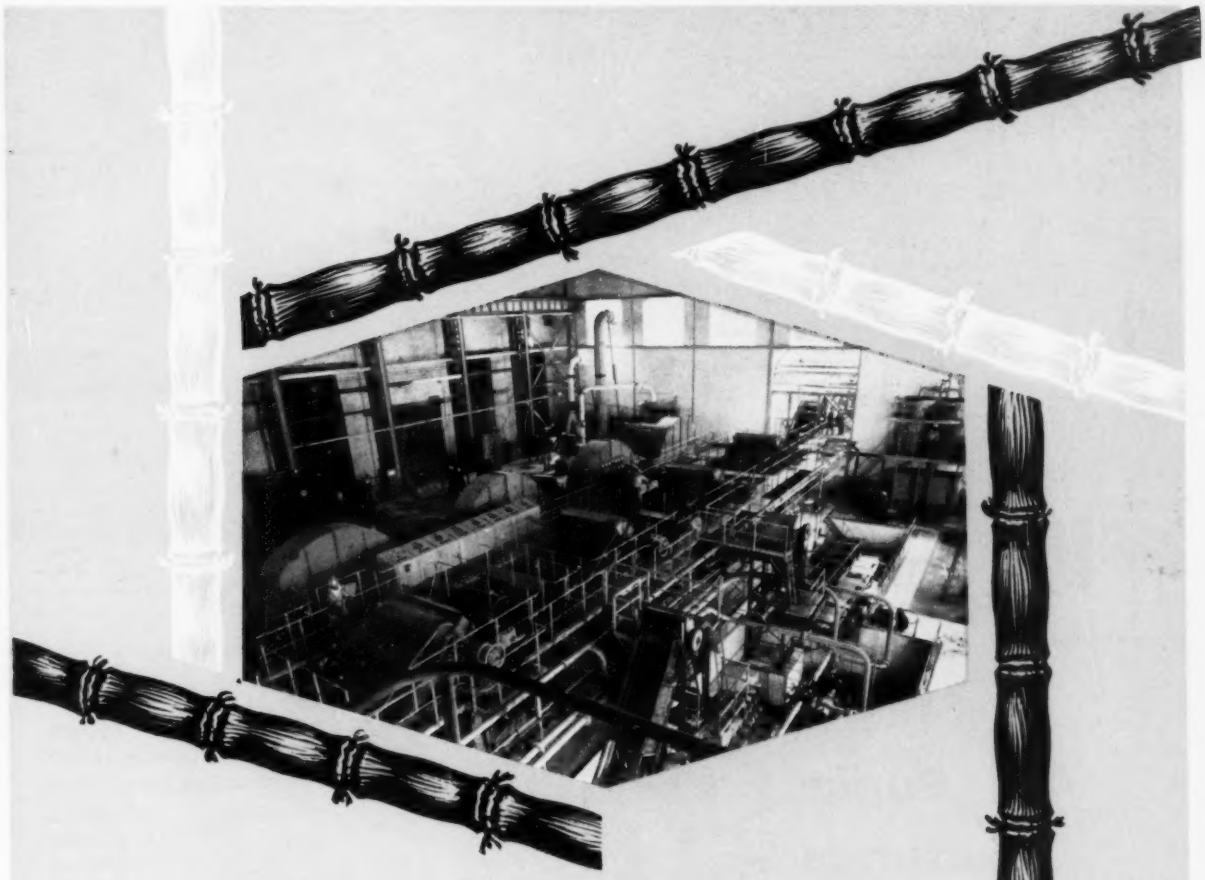
This 640 ft. Sandvik steel band conveyor operating in a Beet Sugar factory discharges its load at any point along its length on either side to storage hoppers by the use of a travelling plough. There are now hundreds of these conveyors installed by Sandvik all over the world, handling beets, beet slices, pulp, raw sugar, refined sugar, sludge, bonechar, bags and boxes etc. For further information write to :—

Sandvik

STEEL BAND CONVEYORS LTD.

DAWLISH ROAD, SELLY OAK, BIRMINGHAM 29.

Tel: SELLY OAK 1113-4-5. Grams: Simplicity, Birmingham.



SKODA SUGAR CANE CRUSHING STATION

driven by individual economic steam turbines controlled from one central panel secures

- **easy attendance**
- **accurate regulation**
- **low consumption of steam**
- **fuel savings**

We deliver the complete machinery and equipment as well as individual equipment for cane and beet sugar factories and refineries and carry out reconstructions.

Dozens of sugar mills constructed in many countries in past years prove the traditional high standard of the Skoda equipment.

TECHNOEXPORT Foreign Trade Corporation for Export of Complete Industrial Plants, Praha, Czechoslovakia.

Sugar Factories Equipped with John Thompson Steam Generation Plant

Country	J. T. Boilers Producing Tons of Sugar per Year	Country's Estimated Sugar Production (tons).
Argentina	4/102,800	880,000
Australia	51/574,800	1,360,000
Brazil	11/3,500	2,880,000
British Guiana	25/300,000	300,000
British East Africa	1/25,000	145,000
British West Indies	4/52,250	580,000
Ceylon	2/36,800	45,000
Dominican Republic	6/188,000	890,000
Egypt	1/108,500	300,000
Fiji Islands	12/102,000	192,000
India	114/504,110	2,275,000
Mexico	1/30,000	1,500,000
Mauritius	2/35,400	520,000
Pakistan	27/111,500	210,000
Philippines	11/88,550	1,150,000
South Africa	3/87,000	990,000
Spain	1/11,400	26,000
Venezuela	3/30,200	205,000
	TOTAL: 279/2,391,810	14,448,000

ESTIMATED WORLD CANE SUGAR PRODUCTION 28,000,000 tons

The above analysis is for 1959, being compiled with figures taken from the International Sugar Journal; it shows that factories equipped with John Thompson Steam Generation Plant were responsible for 8.5% of the world's cane sugar production. Since this analysis John Thompson have secured orders for eighteen more boilers for the Cane Sugar Industry, giving a higher percentage.

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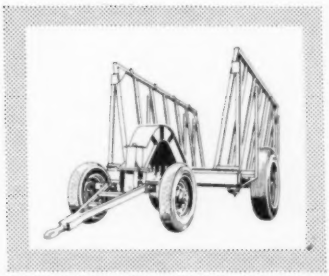

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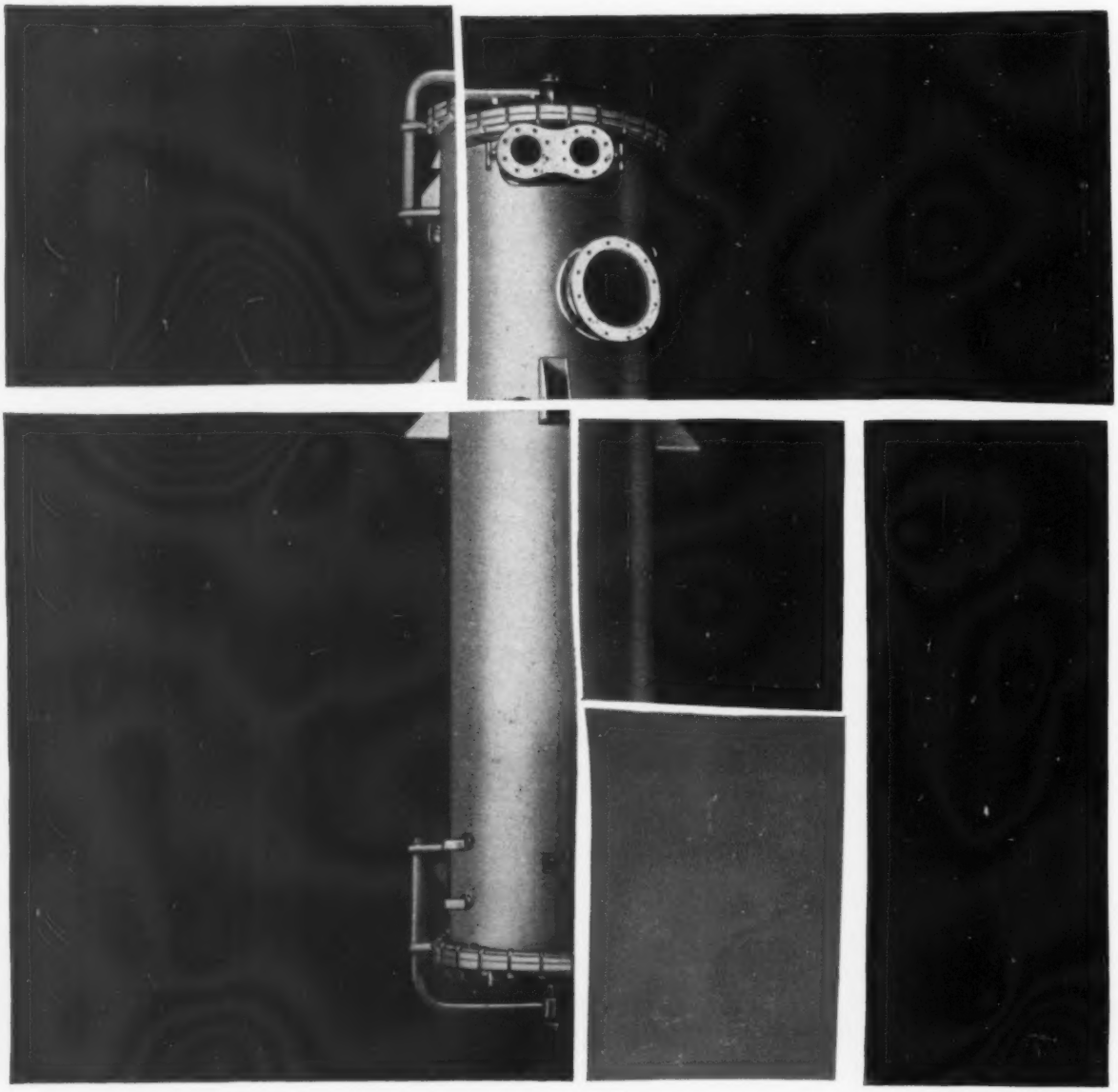

International Sugar Journal

VOL 63 *September, 1961* No. 753

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Published by
The International Sugar Journal Ltd.
Central Chambers, The Broadway,
London, W.5.
Telephone : EALing 1535
Cable : Sugaphilos, London.

* * *

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents post free

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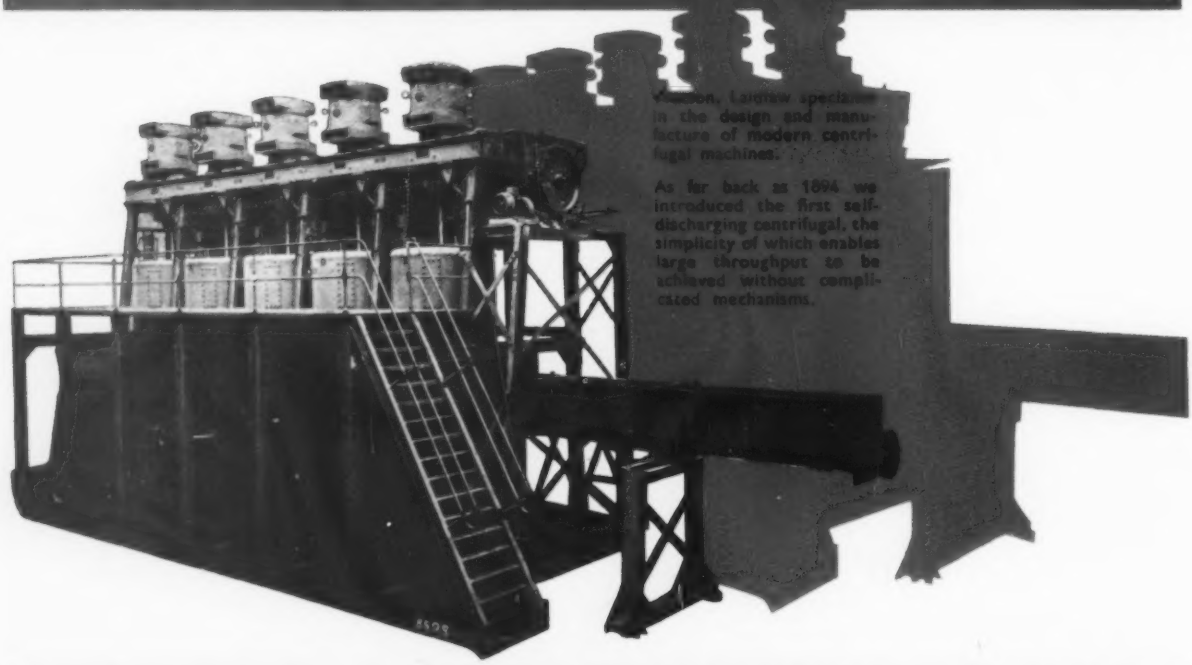
Self discharging centrifugals



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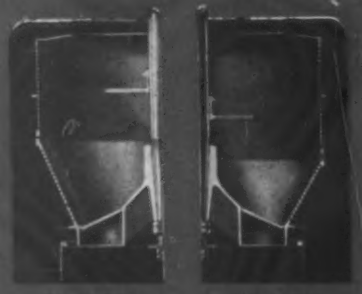

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THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXIII SEPTEMBER, 1961 No. 753

NOTES AND COMMENTS

Britain and the E.E.C.

The question of sugar will be one of the topics under negotiation as a result of the application by the U.K. Government to join the Common Market. General negotiations will undoubtedly be lengthy, and it is by no means certain that it will be possible for Britain to join since she has obligations to the Commonwealth and members of E.F.T.A. which must be taken into account. Among these is the Commonwealth Sugar Agreement, the importance of the preservation of which has been emphasized by representatives of the U.K. and the Commonwealth sugar exporters. All the E.E.C. countries are participants in the International Sugar Agreement, as are Ireland and Denmark both of which are seeking membership or association with the Community. A result of the applications for membership will be the increased interest in the proceedings at the Conference to be held in Geneva this month to review the 1958 International Sugar agreement.

* * *

South Africa and the Commonwealth Sugar Agreement.

Representatives of the South African Sugar Association have been in London to discuss with the Ministry of Agriculture, Fisheries and Food the position of the Association in the Commonwealth Sugar Agreement following South Africa's withdrawal from the Commonwealth.

The following statement was given to the Association setting out the view of the United Kingdom Government on this matter.

"1. The United Kingdom Government has given careful consideration to the position of the South African sugar industry and exporters in the Commonwealth Sugar Agreement following South Africa's withdrawal from the Commonwealth. The Government has come to the conclusion that, in view of the general character and objectives of the Commonwealth Sugar Agreement, continued participation in the Agreement by the South African sugar industry and exporters is not compatible with South Africa's status as a foreign country.

"2. It is not proposed that South Africa's withdrawal from the Commonwealth should affect the Sugar Board's contracts to buy sugar from South Africa in the year ending 31st December 1961, which were made before that withdrawal, and the United Kingdom Government is willing to regard the rights and obligations of the South African Sugar Association under the Commonwealth Sugar Agreement as continuing until the end of 1961; but will consider them as terminating at that date.

"3. The United Kingdom Government will be ready to consider with the Government of South Africa and the South African Sugar Association before the end of 1961 what relationship between South Africa and the United Kingdom in respect of the trade in sugar between the two countries would be appropriate in the altered circumstances.

"4. Since South Africa will, after 1961, no longer be an exporting territory under the Commonwealth Sugar Agreement an amendment to Article 16 of the International Sugar Agreement will be necessary. The United Kingdom Government does not consider that it would be appropriate for South Africa to have a joint quota under the International Sugar Agreement with the exporting Commonwealth territories in the Commonwealth Sugar Agreement. An adjustment will have to be made to the joint quota of the Commonwealth Sugar Agreement exporting territories, to take account of the fact that it will no longer cover South Africa. If the South African Government wishes to remain a member of the International Sugar Agreement, a separate quota for South Africa will have to be agreed at the forthcoming conference to negotiate international sugar quotas. The United Kingdom Government considers that the appropriate reduction to be made to the joint quota would be South Africa's share of the current quota in Article 16, i.e. approximately 217,000 long tons. The United Kingdom Government will be prepared to give its full support to South Africa in seeking to obtain a separate international quota equivalent to this figure."

It was agreed that the further discussions envisaged in paragraph 3 of this statement should be held in

time to allow new arrangements—which must necessarily be bilateral—for the trade in sugar between South Africa and the United Kingdom to take effect from the 1st January 1962, although it will be necessary to await the outcome of the forthcoming International Sugar Conference (to be held from 12th September to early October) before the discussions can reach a definitive stage.

* * *

Increased surcharge on sugar.

The surcharge on sugar, levied by the Sugar Board, was increased on 2nd August 1961, by 2s 4d per cwt. to 18s 8d of refined sugar (by ¼d to 2d per lb). The old rate had been in force since 22nd January 1959.

The new rates are set out in two Orders made by the Minister of Agriculture, Fisheries and Food under the Sugar Act, 1956 and published on the 1st August. The increase in the surcharge is necessary because the Board are required, by Section 4 of the Sugar Act, 1956, to balance their revenue account "taking one year with another". In recent months the world market price of sugar has fallen by considerably more than the present increase in surcharge.

The last published Report of the Board showed that at the end of June, 1960, it had an accumulated deficit of about £7 million. Its accounts for the year ended June 30th, 1961, are not yet published. As a result of the change the first hand (ex refinery) selling price of refiner sugar will rise by 2s 4d per cwt. Retail prices are not controlled although, in general, they follow significant movements in the first hand price.

* * *

U.S. supply quota, 1961.[1]

Following the termination of business in New York on the 31st July the United States Department of Agriculture announced shortfalls amounting to 476,275 short tons in respect of Puerto Rico and Hawaii. The tonnages, considerable as they are, came as no surprise to the market for it had been known for some time that a relinquishment of around 500,000 tons in the United States quota by these two territories was inevitable.

Under the terms of the U.S. Sugar Act domestic producers are entitled to share any shortfalls that might occur in the domestic area. The Virgin Islands, owing to insufficient supplies, were unable to accept any further additions to their quota of 17,330 short tons and accordingly the 476,275 tons have been reallocated, 431,397 tons to domestic beet and 44,878 tons to mainland cane. Production prospects in respect of the two recipients are reported as being good and it appears that both areas can readily absorb this additional tonnage.

* * *

Iran sugar industry[2]

The following report on the present status of the Iranian sugar industry and the new refinery of Ahwaz was published in the newspaper "Kayhan International" (Teheran):—

The sugar industry was a State monopoly until three years ago, but there are now eight privately owned sugar factories and two refineries in operation or under construction. The annual production of the Iranian sugar industry amounts to 150,000 tons of refined sugar which saves the country 10 million dollars in foreign exchange for sugar imports.

The first sugar factory in the country was built 67 years ago by Maschinenfabrik Buckau R. Wolf, Grevenbroich, but not put into operation until 1932. Under the industrialization scheme of Shah Reza the sugar industry was also expanded. Between 1932 and 1948 the Škoda Works constructed nine sugar factories.

Sugar consumption today has risen to 350,000 tons per year. This rapid increase is due to population growth and the higher standard of living enjoyed by all classes of the population. Annual per caput consumption now amounts to 15 kg. In order to increase the production of sugar, a Government Decree granted private enterprises permission to build sugar factories.

As a result the Ahwaz Sugar Refining Co. Ltd. was founded with a capital of 200 million Rials. The machinery was supplied by Maschinenfabrik Buckau R. Wolf A.G. It has a daily processing capacity of 140 tons of raw sugar and produces 130 tons of loaf sugar and cube sugar. With an annual production of 50,000 tons of refined sugar, Ahwaz is Iran's largest refinery.

At present, experimental plantings of sugar cane on salt-free soil are being carried out, but are still in the preliminary stages. Experimental plantings of sugar beet are being undertaken in the vicinity of Ahwaz for which a special seed variety supplied by Kleinwanzlebener Saatzucht is used. Sowing takes place in the summer and harvesting in March. Mr. A. Azod is of the opinion that two new sugar factories could be built and four Government-owned factories expanded provided that beet cultivation is further intensified. This, amongst other factors, depends on the completion of the dam at Dez whereby the problem of irrigation will be solved. At present, the yield per hectare amounts to 10 tons of beet, which, with the aid of artificial fertilizer and modern cultivation and harvesting methods, could be raised to 40 tons.

Cuban agricultural diversification moves[3].—According to unofficial reports the Cuban Government plans to limit the sugar cane acreage in 1962 in order to diversify agricultural activities. It is probable that greater areas will be devoted to cotton, tobacco, etc., at the expense of sugar cane. This plan would in part account for the high 1961 sugar production in Cuba, since all available cane was cut therefor. This plan may be thought to be a first step towards giving up monoculture of sugar cane in Cuba. In line with plans for diversification are reports[4] that Cuba is considering the sale of over 50 sugar mills to Mainland China.

[1] C. Czarnikow Ltd., *Sugar Review*, 1961, (519), 138.
[2] *Zeitsch. Zuckerind.*, 1961, **86**, 217.
[3] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (Supp. 11), 147.
[4] C. Czarnikow Ltd., *Sugar Review*, 1961, (518), 133.

A RESEARCH BACKGROUND FOR RECOMMENDATIONS FOR SUGAR CANE FERTILIZATION

By L. D. BAVER
(Director, Experiment Station, H.S.P.A.)

PART III

Yield in relation to Composition

Nitrogen and potash fertilization increases yields and raises the N and K composition of the plant. It is important to know to what extent composition at any given time can be correlated with yields. It is recognized that yields are affected by many factors other than nutrition, particularly soil differences and the variations in the climatic growth potential of the environment. In order to evaluate the composition factor more accurately, it is necessary to study the composition-yield relationship on an individual plantation basis.

Typical curves showing the relationship of 8–10 N and leaf N at eight months of age and sugar yields at harvest are shown in Fig. 17. An analysis of these curves along with those from other plantations brings out the following significant facts concerning the relationship of plant N and yields of sugar (TSA) when analysed at each plantation:

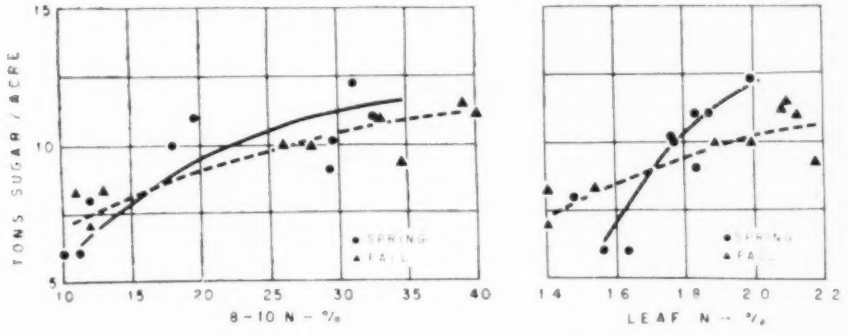

Fig. 17.—The relation of sugar yields to plant N–8 mo. Lihue Plantation Co.

1. All curves begin to flatten as the 8–10 N exceeds about the 0·3% level and the LN is above about 2·0%. These values confirm those suggested by BURR[1] for averages of samples taken at 6, 8, 10 and 12 months of age.

2. There is little difference between the stalk and leaf tissues at any given plantation with respect to the amount of scatter around the respective yield curves.

3. The curve for each plantation has its own shape, generally speaking. The curves for the spring and fall crops are usually different. This should be expected because of the different environmental conditions at a given age for the two plantings.

4. A relationship between plant N and TSA holds true at different ages between 6 and 12 months. The curves become steeper at 10 and 12 months due to the normal decrease in composition with time following nitrogen fertilization.

Owing to the effect of factors other than plant N on the variation in cane yield from plantation to plantation, one should not expect a very high correlation between the nitrogen composition of plant tissues and sugar yields when all plantations are grouped together. The scatter of the various points was so large that it is not feasible to present the graphs in this publication. The following correlation coefficients were obtained for TSA (average of 21 and 24 months) against plant N (8 months):

TSA *vs.* 8–10 N = 0·584

TSA *vs.* leaf N = 0·523

It was found that only between one-fourth and one-third of the yield variations between plantations can be attributed to differences in nitrogen composition. From an analysis of all the data, it would appear that at eight months of age the 8–10 N should be above 0·30%. At 12 months, this value is between 0·25 and 0·30%.

Curves relating 8–10 reducing sugars and 8–10 moisture to yields of sugar have the same shape as the N–TSA curves (Fig. 18). This is especially true for the 8–10 RS–TSA curve. It was shown in Fig. 8 that 8–10 N and 8–10 RS were very highly correlated. The data in Fig. 18 are further confirmation of this relationship. Since reducing sugars are so highly correlated with both plant nitrogen and plant moisture (Fig. 13), one should expect to obtain similarly shaped curves relating N, RS and M to TSA.

Only Grove Farm, Lihue, Olaa and the site of the fall planting at Pioneer showed definite responses to potash fertilization. These responses were in line with the available soil potassium analyses (Fig. 10). The data in Fig. 19 show the TSA:8–10 K curves for the aforementioned plantations. The following points from these curves are of interest:

[1] *Rpt. Hawaiian Sugar Tech.*, 1956, 44.

1. Although the curves exhibit the same general shapes as those for N–TSA, the response per unit of 8–10 K is not as marked as for 8–10 N.

2. There is a tendency for the curves to flatten at 8–10 K values of between 0·6 and 0·8%. At Pioneer, the 8–10 K for 400 lb K_2O was only slightly in excess of 0·4%, which is inadequate to give a picture of the curve at higher compositions.

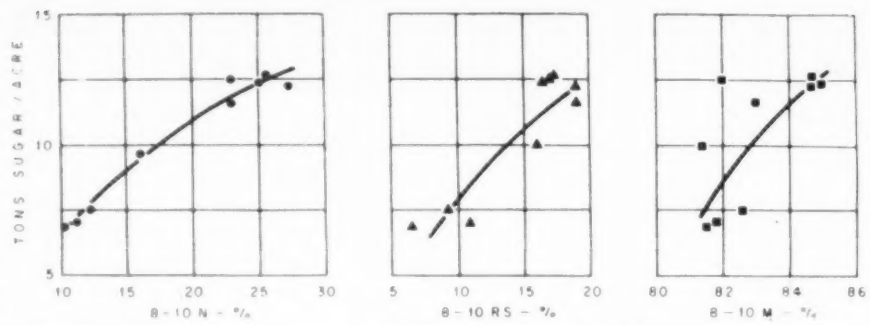

Fig. 18.—The relation of sugar yields to 8–10N, 8–10RS, and 8–10M–8 mo. Grove Farm Co.

3. The values for both spring and fall crops fall on the same curve.

Yield response in relation to composition

If yield responses could be presented in terms of percentage increases over the check for both nitrogen and potash fertilization as related to plant composition of the check, such information should enable one to establish plant composition levels for estimating the need for fertilizer applications.

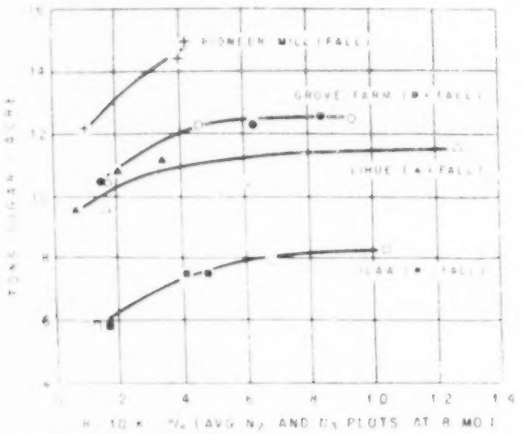

Fig. 19.—The relation of sugar yields to 8–10K–8 mo.—at four plantations

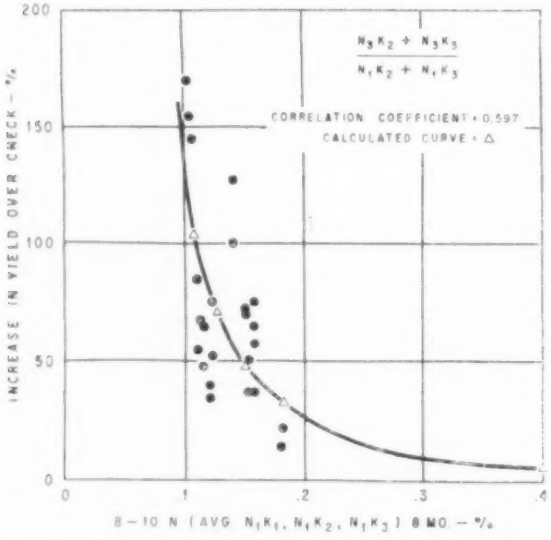
$\frac{N_3K_2 + N_3K_3}{N_1K_2 + N_1K_3}$
CORRELATION COEFFICIENT = 0.597
CALCULATED CURVE = △
INCREASE IN YIELD OVER CHECK - %
8 - 10 N (AVG N_1K_1, N_1K_2, N_1K_3) 8 MO. - %

Fig. 20.—Percentage yield response as related to 8–10N composition of no-nitrogen plots

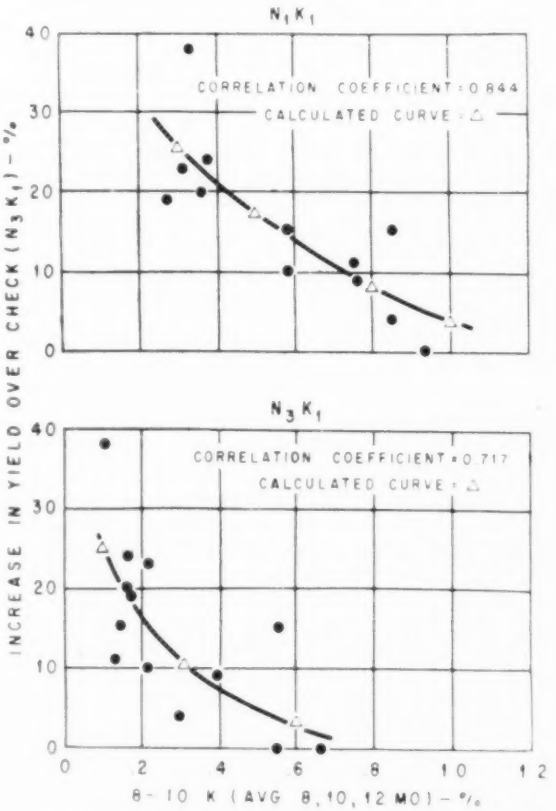
N_1K_1
CORRELATION COEFFICIENT = 0.844
CALCULATED CURVE = △
N_3K_1
CORRELATION COEFFICIENT = 0.717
CALCULATED CURVE = △
INCREASE IN YIELD OVER CHECK (N_3K_1) - %
8 - 10 K (AVG 8, 10, 12 MO.) - %

Fig. 21.—Percentage yield response as related to the 8–10K composition of no-potash plots

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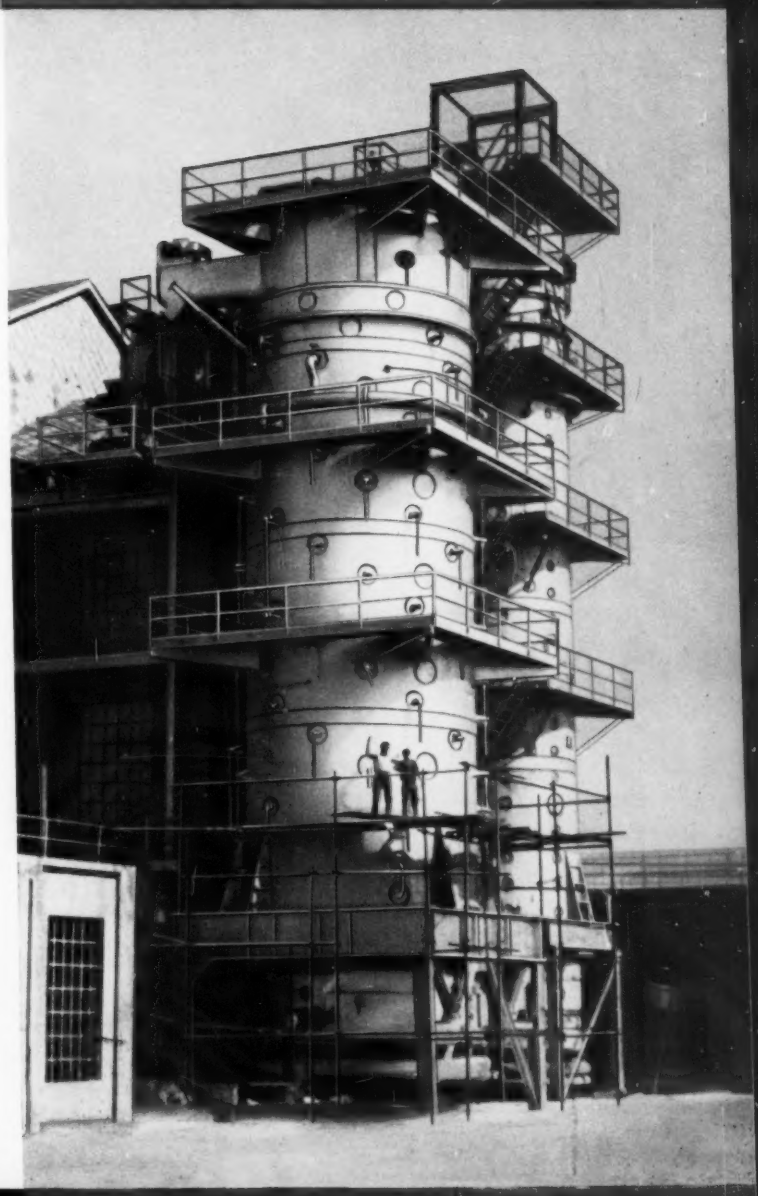

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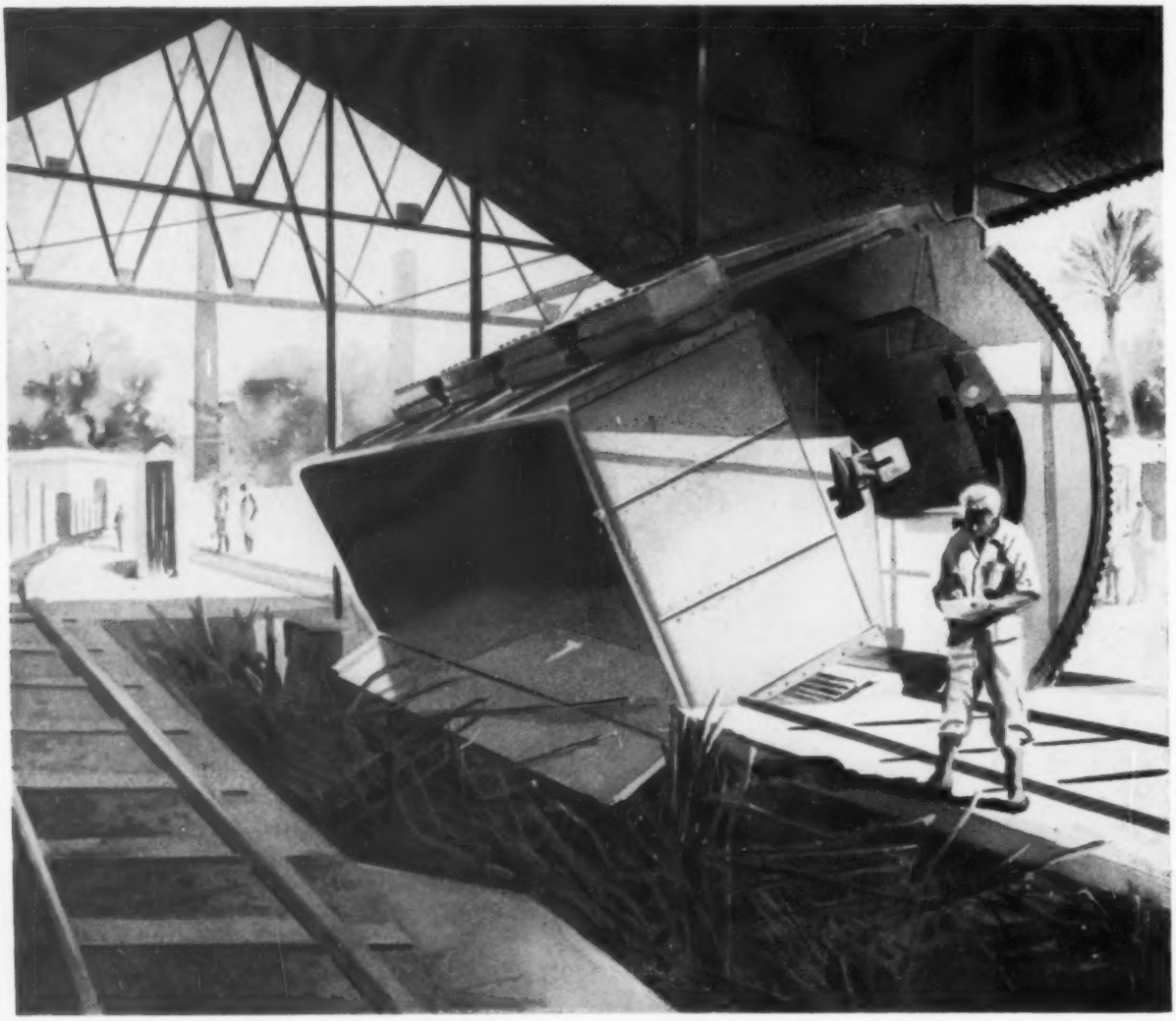

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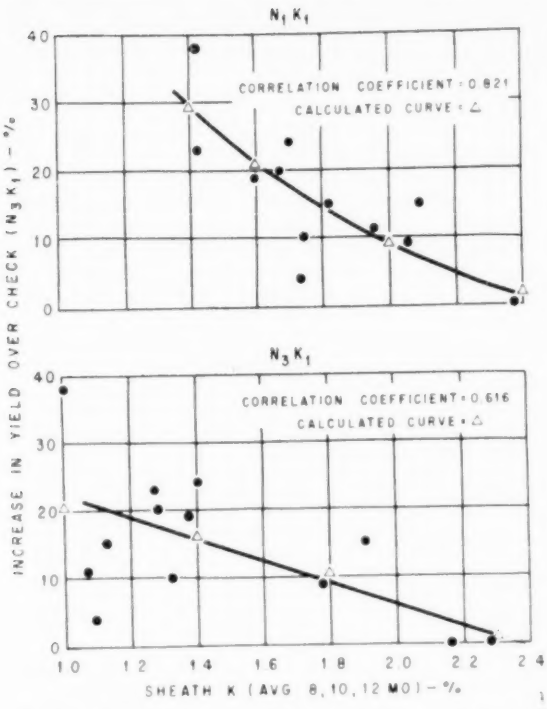
N1K1
CORRELATION COEFFICIENT = 0.821
CALCULATED CURVE = △
N3K1
CORRELATION COEFFICIENT = 0.616
CALCULATED CURVE = △
INCREASE IN YIELD OVER CHECK (N3K1) - %
SHEATH K (AVG 8, 10, 12 MO) - %

Fig. 22.—Percentage yield response as related to the sheath K composition of no-potash plots

The curve in Fig. 20 shows the percentage increase in yield over the check obtained with the application of 300 lb N per acre. These yield increases were obtained by combining the yields of the K_2 (200 lb) and K_3 (400 lb) plots. The plots with no potash applications were omitted so as to remove any effects of potash deficiencies. Unfortunately, the correlation coefficients relating the percentage increase in yields to the nitrogen composition of plant tissues from no nitrogen checks are not too satisfactory, since only between 25 and 36% of the variation can be explained by the nitrogen composition of the check.

The correlation coefficient of 0·597 for 8–10 N was superior to the 0·490 for leaf N. The percentage increase obtained by N fertilization rises rapidly when the 8–10 N of the checks falls below about 0·175% at eight months of age. The calculated curve shows a distinct flattening when the N levels exceed about 0·3%.

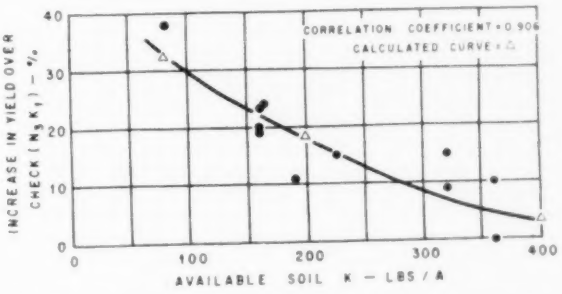

Fig. 23.—Percentage yield response as related to the available soil K of unfertilized plots

The potash response data present a much better picture than the nitrogen results. This fact is illustrated in Figs. 21, 22 and 23. The upper portions of Figs. 21 and 22 represent the K values in the unfertilized check, N_1K_1; the lower portions are for the N_3K_1 plots. The two had to be separated because of the N effect upon K composition, as previously discussed. The data from these curves permit the following conclusions:

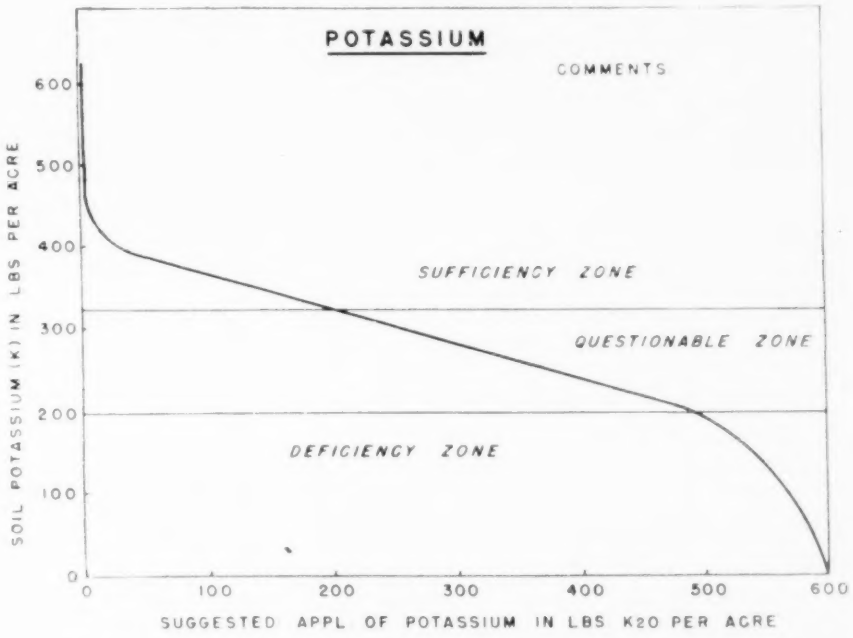

Fig. 24.—Potash fertilization recommendations in relation to the available K in soil (by A. S. Ayres)

1. The K-% increase-in-yield curves show higher correlation coefficients than similar curves for N.

2. Although the 8–10 K values are slightly more highly correlated than sheath K, there is little to choose between the two tissues as far as reliability is concerned.

3. The N effect upon the K values of plant tissues is clearly shown in both Figs. 21 and 22. This effect exhibits itself in two ways. First, the correlation coefficients for the N_1K_1 plots are higher than those for N_2K_1. Second, nitrogen lowers the composition value above which there is little response to potash fertilization. For example, in Fig. 21 for 8–10 K, there is little response in yields in the absence of N when the K values are above about 1·0%; in the presence of N, this figure is lowered to about 0·7%. In Fig. 22 for sheath K, little response is obtained in the absence of N when the K values are above 2·4%; in the presence of N, this figure is lowered to about 2·3%. BURR[2] suggested an 8–10 K level of about 0·66%, above which little response to potash fertilization may be expected. CLEMENTS and co-workers[3] suggested 2·25 as a satisfactory level for sheath K. Referring now to Fig. 10, it is seen that a sheath K level of apout 2·2% corresponds to an available soil K value of 325 lb per acre. For 8–10 K, the corresponding value is about 0·8%.

4. The highest correlation with the percentage increase in yields is found in Fig. 23 in which available soil K is compared with fertilizer response. Here the correlation coefficient is 0·906 as compared with 0·6 to 0·7 when plant tissues from N-fertilized plots are used (which will be the standard case under plantation conditions). The curves in Fig. 23 suggest a value of about 400 lb per acre of available K above which one should expect little or no increase from potash fertilization. This is higher than the 325 lb sufficiency figure established by AYRES (Fig. 24). It is worthy of note in Fig. 24, however, that no potash fertilizer is recommended above 400 lb per acre of available soil K. These data again emphasize the value of available soil K analysis in fertilizer recommendations.

(*To be continued*)

AGRICULTURAL ABSTRACTS

Payment for cane on the basis of quality. A. LÓPEZ R. DE P. *Bol. Ofic. A.T.A.C.*, 1960, **19**, 324–328.—A somewhat complex formula, based on figures for crusher juice, is given for the calculation of the production of each colono.

* * *

Data concerning cane smut in Tucumán. W. E. CROSS. *La Industria Azucarera*, 1960, **66**, 489, 531–546.—Cf. *I.S.J.*, 1960, **62**, 239, 271.

* * *

Greyback cane beetle. S. O. SKINNER. *Cane Growers' Quarterly Bull.*, 1961, **24**, 83.—Ten years of success in controlling the pest by the use of BHC have created the impression that its attack is reduced to negligible proportions. It is pointed out that the beetle is indigenous to Australia while sugar cane is not, and instances are given of damage to pineapples and, particularly, guinea grass. A warning is issued against any relaxation of precautionary measures.

* * *

A droopy top trial. L. G. VALLANCE. *Cane Growers' Quarterly Bull.*, 1961, **24**, 85.—Originally intended to determine the optimum dressing of copper sulphate, the interesting feature is the value of molasses as a control, the respective figures being: no treatment 18·3 tons, 42 lb/acre copper sulphate 29·4 tons, 56 lb/acre copper sulphate 28·9 tons, molasses 5 tons/acre 28·4 tons.

A useful machine for planting supplies. I. T. FRESHWATER. *Cane Growers' Quarterly Bull.*, 1961, **24**, 88. The main reason for planting supplies is weed control, for they add little to crop growth. The economy of the practice is doubtful owing to the high cost. The machine here described aims at reducing this cost.

* * *

"Dalapon" plus 2,4-D for control of weeds in irrigation channels. L. S. CHAPMAN. *Cane Growers' Quarterly Bull.*, 1961, **24**, 115.—The method of application is spraying. Various modifications of the chemicals used are suggested.

* * *

Q.67 in the Burdekin District. J. WESTROP. *Cane Growers' Quarterly Bull.*, 1961, **24**, 140–142.—Full details are given of the behaviour of this variety under commercial cultivation. Its main advantage is its erect habit.

* * *

The formulation of a manurial schedule in respect to phosphate absorption through foliar analysis. III. J. C. BHARGAVA and S. C. SEN. *Indian Sugar*, 1960, **10**, 457–459.—The effects of P_2O_5 at the rate of 20, 40, 60 and 80 lb/acre under both low and high irrigation were compared on the basis of P_2O_5% dry matter in the 4th leaves. There was no significance in the resulting figures.

[2] *Hawaiian Planters' Record*, 1955, **55**, 106.
[3] *Hawaii Agric. Expt. Sta. Ann. Rpt.*, 1946, 108–111.

THE SUGAR CANE IN GHANA

TO one who had not previously thought about it, it must have come as a surprise that the only sugar cane grown in Ghana is for chewing and that the territory is dependent on imports for 35,000 tons, a consumption costing some £2·5 million per annum. The country as a whole, and certain areas in particular, possesses a climate no less favourable for cane cultivation than many territories in which sugar production constitutes an important item in their economy. The explanation, perhaps, lies in the fact that cacao dominates the economy. That phase is passing and the first fruits of an attempt to widen the economy by the inclusion of sugar cane to meet the local demand for sugar are reported in a recent Technical Bulletin[1]. The area chosen lies in the Accra plains, the soils of which belong to the Akuse/Prampram series, and consist of black clays of high potential productive capacity but difficult to work. These soils, with their high clay content (30–50%), develop large cracks on drying and become plastic and sticky on wetting, soon reaching a waterlogged condition. Their nutrient status is high except in the case of P; pH is slightly alkaline at surface passing to strongly alkaline in the sub-soil. Cultural difficulties are increased by the seasonal distribution of rainfall; in the North, of an average of 44 in per annum, 50% falls between March and June and 36% between September and November. The Southern area receives 30 in only, 63% of which falls between March and June.

The two factors, seasonal rainfall and high run-off characteristic of such soils, necessitate irrigation which, in its turn, raises cultural difficulties with soils of so low a capacity of water acceptance. Interest centres, therefore, on the system of "broadlands" evolved. These are modified cambered beds, 24 ft to 30 ft over-all and set to a gradient of 1:500 by ploughing round and round the heading. On such broadlands cane is planted on four or five ridges. The superiority of this system over that previously adopted of land levelling, i.e. mechanized cutting of soil and filling depressions, is discussed in some detail. Similarly discussed are the factors affecting irrigation procedure.

Early trials of varietal performance offered little guide, being conducted on land suffering from intensive levelling. The change in crop management has led to a nearly doubled yield. There are two planting seasons, April and October, the latter giving a somewhat higher yield of cane and sugar at 12 to 12·5 months. B. 41227 gave the highest cane yield at 66·8 tons per acre but only yielded 10·72 tons sugar per acre; the respective figures for B. 34104, which headed the list for sugar, were 63·2 tons and 12·54 tons.

All experiments so far conducted indicate response to fertilizer only in the case of P and that only slight. It has to be remembered, however, that these are virgin lands with a stored up fertility which may soon be lost, a loss most likely to occur soonest in the organic fraction. As the figures, C 1·2–1·4%, N 0·107% and C/N ratio 13–15, show, this fraction is already low in C while the exchangeable cations in meq/100 g soil are, Ca 25–35, Mg 10–14, K 0·2–0·3, Na 0·2–1·5.

H.M.-L.

SUGAR CANE AGRICULTURE IN CUBA

THIRTY-SECOND CONFERENCE, ASSOCIATION OF SUGAR CANE TECHNOLOGISTS OF CUBA, 1958

IN a paper by R. BERNAL C. is described a method for evaluating the weight of cane before cutting. The method is based on determining the average cane plant in each field. Tables are provided for calculating the number of plants from centre-to-centre distances from which the weight of crop is calculated on a basis of stalk length.

H. G. SORENSEN considers field trials as the only correct method of determining the composition and quantity of fertilizer required in a given field, and illustrated his conclusion by reference to two experimental plots on the Cunagua and Jaronú estates. An experiment, using N, P and K each at three levels, was described by A. S. VALDIVIESO, which includes observations on their interactions.

From varietal experiments over the past years R. BARRETO D. has drawn the conclusion that, among the new Cuban and imported varieties, there exist some far superior to the varieties at present grown commercially.

F. PINEDA presented a report on the nematodes found in the plantations of Central Adelaida, Camagüey Province, and on the nature of the injury done by the respective species. There followed a report by T. G. CLEASBY on experience in Natal in nematode control by fumigation.

H.M.-L.

The sugar cane scale and its problems. R. A. AGARWAL. *Indian Sugar*, 1960, **10**, 523–525.—The nature of the damage caused by, and the differential varietal resistance of, both *S. spontaneum* and *S. officinale* and their hybrids to the scale insect, *Melanaspis* (*Targionia*) *glomerata* are described.

[1] "Preliminary observations on the performance of sugarcane at the Agric. Irrigation Res. Sta., Kpong." J. M. L. KOTWAL and P. R. HILL: *Tech. Bull.* (Faculty Agric. Univ. of Ghana), 1960, (1), 29 pp.

Studies on the response of sugar cane to phosphatic fertilizers. E. J. RAO *et al. Indian Sugar*, 1960, **10**, 581–587.—No response was obtained either in yield or juice quality from P dressing at 100 lb/acre P_2O_5 whether with or without N in an experiment covering three years.

* * *

Experiments with salt and potash on sugar beet in South-East Scotland. J. C. HOLMES *et al. Experimental Husbandry*, 1961, (6), 1–7.—As there was evidence to suggest that the application of salt (sodium chloride) was less effective or beneficial with sugar beet in Scotland than in other parts of the British Isles, a series of experiments were carried out during the period 1951–57. Conclusions reached were that in the Scottish beet-growing area salt should be applied in addition to potash on soils where the available potassium status is low or tending to be low, especially if dung is not applied. On the other hand on high potash fields salt should not be applied in addition to potash.

* * *

Ploughing down fertilizer for sugar beet. J. WEBBER. *Experimental Husbandry*, 1961, (6), 8–12.—Ploughing down fertilizer for sugar beet to a depth of 6–8 inches has been known to increase yield in some areas, compared with the same amount of fertilizer applied to the seed beds. In the light soils of the vale of York, where sugar beet is an important crop, experiments completed during the period 1954/57 indicated that there was little if any advantage in the ploughing down of fertilizer, as compared with customary seed-bed application.

* * *

Protein from sugar cane. D. H. PARISH. *Rev. Agric. Sucr.* (Mauritius), 1960, **39**, 343.—Attention is drawn to the work of PIRIE at Rothamsted on the extraction of leaf protein. It is calculated that 6,000 tons of protein are available in Mauritian cane juices to meet the deficiencies in the standard diet. Studies of the amino-acid composition and nutritional value of the heat-coagulated precipitates are in progress.

* * *

The effect of gibberellic acid on the growth of spring paddy sugar cane. H. CHANG and R. C. LIN. *Taiwan Sugar*, 1960, **7**, (9), 18–20.—Though increase of height resulted from early spraying, an increase in dead canes resulted in no increased yield at harvest.

* * *

Urea. J. GORDON. *S. African Sugar J.*, 1961, **45**, 213–215.—A summary is given of the experimental evidence of the relative values of urea and sulphate of ammonia. Loss of N with urea has to be set against the greater losses of minerals through leaching with sulphate of ammonia. It is possible that local conditions may turn the scale in favour of one or the other.

* * *

Experimental results of cultivating methods of Autumn paddy sugar cane. T. P. PAO. *Taiwan Sugar*, 1960, **7**, (10), 16–20.—The date of planting (late August optimum) and methods of planting are described.

* * *

Boron requirements of sugar beet. T. T. YANG. *Taiwan Sugar*, 1960, **7**, (11), 20–22.—Boron deficiency has been identified in Taiwan. Pot and field experiments indicate that the deficiency is primarily due to non-availability which is corrected by organic manuring.

* * *

Ratooning effects of stubble size and trash conservation. J. C. CHOU. *Taiwan Sugar*, 1961, **8**, (1), 13–17.—The common practice of off-barring stubble cane and, except when burning for pest control is desirable, of raking trash into the inter-lines, is reviewed. Removing up to 50% of the stubble has no effect on yield and, under standard fertilizer practice, no benefit was derived from trash conservation.

* * *

Higher quality sugar beets. V. JENSON. *Spreckels Sugar Beet Bull.*, 1960, **25**, 2–4, 8.—The limits of acceptable beet at 12% sugar and 80% purity are such that the farmer may have difficulty in attaining them. A simple system of strip trials with varying units of N and adapted for inclusion in farm practice is described.

* * *

Studies on microflora associated with *S. officinarum*. P. H. MAYEUX and A. R. COLMER. *Sugar J.* (La.), 1960, **23**, (7), 28–32.—A detailed study is given of the micro-organisms found in the leaf-sheath water, cane borer dust, slime formed on the stubble and first roller juice, and on harvested cane stalks in terms of number of bacteria, fungi and yeasts. The suggestion is made that *Aerobacter aerogenes* rather than *Leuconostoc mesenteroides* is responsible for the difficulty sometimes found in handling juice of cane cut and left in windrows.

* * *

Weed control. G. S. BARTLETT. *S. African Sugar J.* 1961, **45**, 207–209.—Recent developments in Natal have been directed to finding a mechanical solution to the weed-control problem to replace total reliance on chemical control.

[1] *I.S.J.*, 1958, **60**, 260–263.

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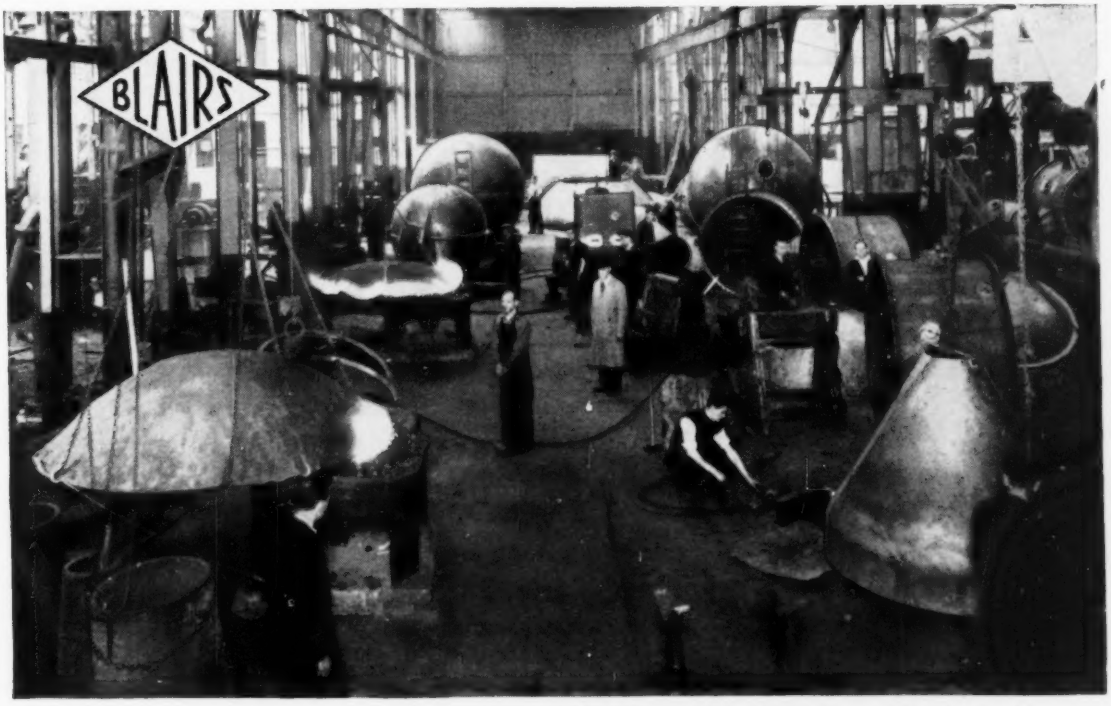

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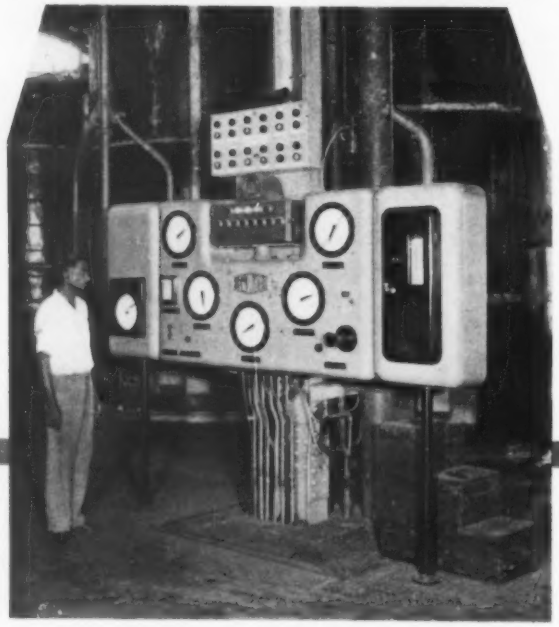

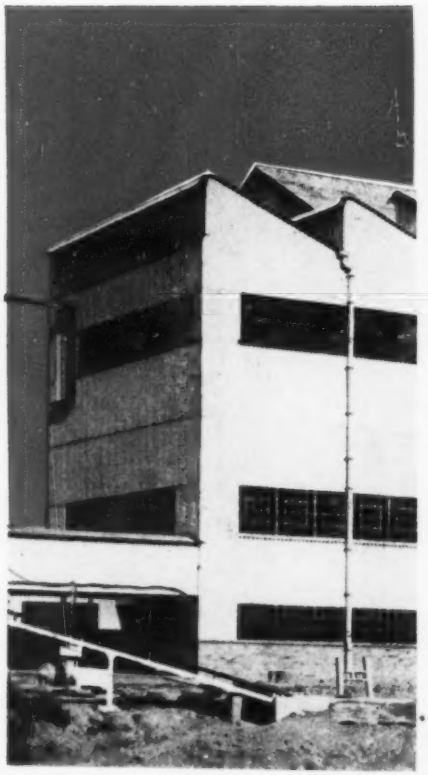

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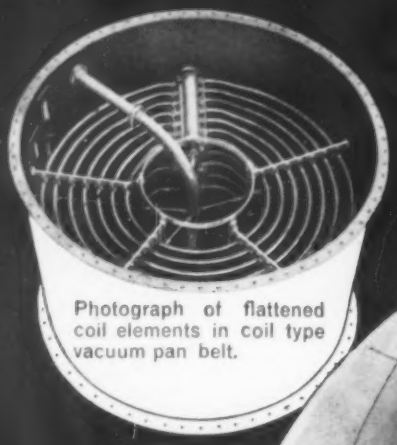

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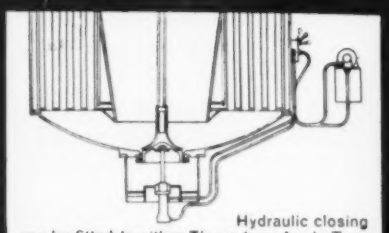

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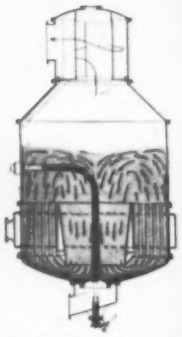

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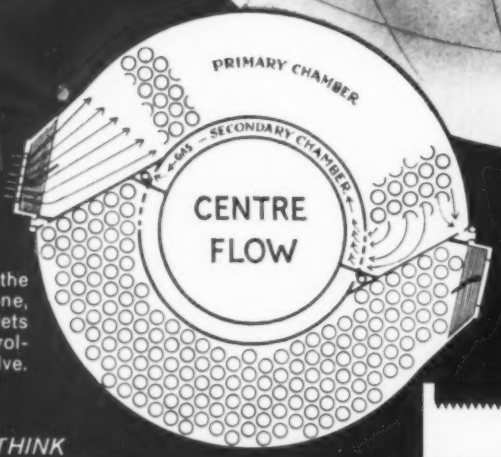

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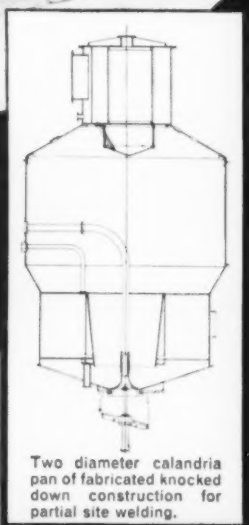

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EVALUATION OF A DE SMET DIFFUSION UNIT

By F. SCHNEIDER, E. REINEFELD and H. P. HOFFMANN-WALBECK
(Sugar Institute, Technische Hochschule, Braunschweig)

PART II

Diffuser Efficiency and Capacity

As regards the diffuser efficiency (diffusion losses and raw juice draught) we carried out tests on three separate days (Series I to III).

The capacity was determined basically from the belt weigher readings. The average values of the analyses are given in Table 1. The values calculated from these, by means of the formula of SCHNEIDER[1] (diffusion losses % pol on beet, raw juice draught weight % on beet, yield of pressed pulp and of exhausted cossettes, press-water quantity), are given in Table 2 together with the amounts of beet processed.

The daily slice was calculated from the hourly average of the time during which operation was uninterrupted. In the event of interruptions not originating in the diffuser, the true processing figure was lower. The diffuser efficiency as the average of the three experiments was: losses of 0·18% pol on beet at a juice draught of 114·2% by weight (107·1 as volume % on beet). Factory results for the same days are given in Table 3 for comparison. These were of the same order of magnitude as the values which we obtained. Agreement was not expected, as the factory results are the average of 24 hours while our tests were carried out only over a period of 11 hours.

The high diffusion efficiency gains further significance when it is realised that the general working conditions were relatively unfavourable for the diffuser. The above-mentioned marked dirtiness of the beets caused frequent stoppages as a result of lack of beet (especially through blockage of the washers). The De Smet diffuser attained its nominal capacity only in Series II, while in Series I and III the beet throughput was somewhat lower than that corresponding to the capacity of the factory or the maximum amount of beet which would pass through the washers.

Table 1

Analytical values

Test series	*Fresh cossettes*		*Exhausted cossettes*		*Pressed pulp*		*Raw juice*			*Press-water*		*Fresh water*
	pol	*dry solids*	*pol*	*dry solids*	*pol*	*dry solids*	*pol*	*Bx*	*purity*	*pol*	*pH*	*pH*
I	16·71	24·01	0·28	8·26	0·30	10·82	14·27	15·93	89·6	0·23	6·1	6·1
II	16·44	23·62	0·29	7·56	0·32	9·59	14·43	16·20	89·1	0·25	6·2	6·2
III	16·70	23·99	0·33	7·61	0·38	9·61	14·46	16·18	89·4	0·27	5·6	6·3
Mean	16·62	23·87	0·30	7·81	0·33	10·01	14·39	16·10	89·4	0·25	6·0	6·2

Table 2

Factory results

Test series	*Throughput***		*Diffusion losses*	*Juice draught*	*Pulp yield*	*Exhausted cossettes quantity*	*Press-water quantity*	
	tons/hr	*tons/day*	*% pol on beet*	*wt. % on beet*	*% on beet*	*% on beet*	*% on beet*	*cu.m./hr*
I	59·6	1430·4	0·16	116·0	53·3	67·9	14·6	8·7
II	63·6	1526·4	0·18	112·7	56·3	69·0	12·7	8·1
III	60·4	1449·6	0·21	114·0	55·3	72·7	17·4	10·5
Mean	61·2	1468·8	0·18	114·2	55·0	69·9	14·9	9·1

** Calculated on uninterrupted hourly processing

Table 3

Performance data

	Daily processing		*Diffusion losses % pol on beet*	*Draught wt. % on beet*
	Actual throughput of beet, tons	*Processing in uninterrupted hour × 24, tons*		
1st day	1413	1510	0·16	111·4
2nd day	1442	1560	0·14	111·1
3rd day	1227	1500	0·18	113·2
Mean	1360·7	1523·3	0·16	111·9

The smaller differences in the diffuser efficiency during the three test series show no connexion with the capacities; the comparatively poor result in Series III may have been caused by "discontinuous operation." As on the one hand, the factory capacity is limited, and on the other, losses in processing must be avoided, there was no systematic variation in the capacity of the De Smet diffuser within the limits of the tests. From the determined and calculated data (Tables 1 and 2) the following was also found: the average sugar contents of the beet were close to one another in the individual test series. The average of the total values was 16·62%, with variations in the individual hourly values from 15·6 to 17·8%. The average pressed pulp yield was 55% on beet (dry solids content 10·0% on average) with only small differences within the individual series. Exhausted cossettes amounted to 69·9% on beet with an average dry solids content of 7·8%. From these data, the average press-water yield amounts to 14·9% on beet, corresponding to 9·1 cu.m./hr.

[1] *Zucker-Beihefte*, 1950, **1**, 1. *See also* "Technologie des Zuckers" (Schaper, Hannover) 1955, p. 191.

Retention Time

With the De Smet diffuser the retention time naturally depends on the cossette blanket thickness and the required throughput. The layer thickness, as has been stated above, may be varied by means of the depth controller. However, relatively narrow limits are applied in practice, since

the diffusion time should be neither too long nor too short, and

the throughput which is required by the factory is fixed.

Furthermore, care must be taken that the cossette layer thickness corresponds as near as possible to its permeability or, conversely, as already stated, the amount of extraction juice must correspond to the cossette layer thickness, regardless of the juice draw-off. These factors are decisive with regard to diffuser efficiency; the optimum will be reached when the cossettes are leached with the greatest possible amount of juice and thereby permeation of the juice through the cossette blanket, which should be uniform, occupies the whole of the diffusion time between each two feed points. Naturally, this optimum adjustment is not always attained, as was observed during the test period.

The retention time was easily determined as the cossettes remained firmly fixed on the conveyor, the speed of which is known. The conveyor was found to be covered with cossettes over 33·3 m of its length. A speed of 7·5 cm per 14 sec, as established during the test period, corresponds to a cossette retention time of about 103 min. The cossettes were in contact with the juice ("scalding zone" included) over about 30·3 m, corresponding to about 94 min.

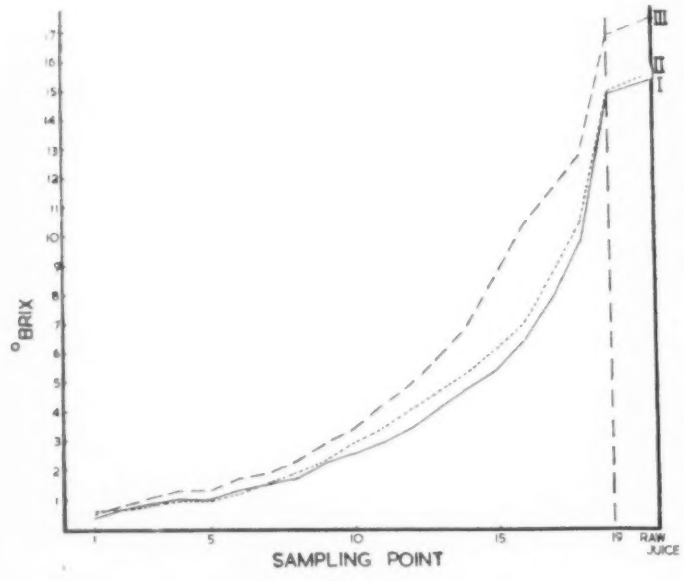


Fig. 5

The cossette retention time or diffusion time is of interest, as the breaking-down and solubilization of the cell tissue of the cossettes and so the passage of additional non-sugars into the raw juice are a function of temperature and time. Thus the period during which the cossettes are subjected to heat is particularly important. One should aspire to a short diffusion time.

We found in tests on various types of diffusers that, for nominal capacity, the requirements of diffuser efficiency (maximum losses of 0·20% on beet at 120% juice draught) laid down by the sugar industry are met by retention times†† of 70–85 minutes.

††By "diffusion time" we mean that period during which the cossettes, heated to the diffusion temperature, are in contact with the counter-current extraction juice.

In the case quoted above it should be remembered that the cossettes at the water end are cooled *in* the diffuser. The diffusion temperature is applied for about 28·8 m, corresponding to a heat effect period of about 90 min. Of this, about 10 min are available for the "scalding zone" and the cossettes are in the actual "diffusion zone" of the diffuser for about 80 min.

The average thickness of the cossette blanket ("normal working range" about 60—70 cm) during the test period‡‡ was

‡‡Variations were caused particularly by differences in cossette throughputs and by interruptions.

—in test Series I 64 cm (61–66 cm)

—in test Series II 67 cm (60–70 cm)

—in test Series III 64 cm (60–67 cm).

From the retention time and the throughput, the "charge" (packing depth) of the cossette layer entering the diffuser (based on fresh cossettes) may be calculated as about 50 kg/hectolitre, roughly corresponding to that of a battery diffuser. Naturally, with further juice extraction, the charging cannot be compared with that of other diffusers, as the cossettes are sprayed in the first case and the cossette layer thickness could decrease with reduction in the bulkiness of the cossettes at the water end. Differences in the permeability of the layer for juice in individual sections of the diffuser have already been discussed.

Extraction

(*a*) *Sugar extraction*

The sugar extraction from cossettes was checked in some test series by withdrawing random samples from all the juice streams and plotting the Brix values in the usual manner against the "diffusion length," which is proportional to the diffusion time. As we know, with uninterrupted counter-current extraction, the data are plotted as a logarithmic function. It should be borne in mind that

in the case of the diffuser tested the relatively large number of sampling cocks permits very accurate control to be maintained.

The curves (Fig. 5) correspond roughly to the expected values and show practically no anomalies. Curve III represents a momentary state at which the juice draw-off was reduced. The perpendicular at sampling point 19 indicates the end of counter-current extraction. The sharp rise in the Brix between points 18 and 19 shows that the fresh cossettes entering the diffuser are well plasmolysed and that de-sugaring starts straight away. The cossettes are maintained in the scalding zone for about 10 min; they should pass through the separator in about 30 sec, and along the flume pipe in about 8 sec.

Cossettes removed from the scalding zone in some random tests revealed a plasmolysis percentage of 93[2].

(*b*) *Temperature*

The temperature of the juice in the individual spray sections was determined at the same time as the Brix. The values are given in Fig. 6. Temperature maintenance in the diffuser was very good; the nominal values were fairly constant at the required level and correspond roughly to the ideal curve for temperature maintenance[3].

Curve II shows a momentary state at which there is a slow temperature rise at the water end, probably as a result of a temporary drop in the press-water temperature. Random samples show a temperature greater than 65°C mostly at the water end at sampling point 2.

Table 4, in which the mean values of the hourly readings are given together with the range of fluctuation, illustrates the excellence of the temperature maintenance. The temperature readings for heaters P3C – P3F are remarkably uniform. Control of cossette pre-scalding allowed too great a fluctuation as was shown by the recorder. To avoid overscalding, the tolerances should be no greater than ±2°C. The temperature of the circulation juice after the heater was so high at times (over 90°C) that our tests revealed a drop in juice quality. It would be better to increase the quantity of circulation juice so that the temperature after the heater did not exceed 85–87°C.

Table 4

Indicated temperatures (°C)

Test series		I	II	III	*Range of fluctuations*
Press-water (entering diffusion)	..	69	68	67	60–71
P 3 A	.. ..	68	65	65	60–70
P 3 C	.. ..	71	70	70	70–72
Heaters P 3 D	.. ..	72	72	72	71–72
P 3 E	.. ..	72	72	72	constant
P 3 F	.. ..	73	73	73	constant
Circulation juice before heater	..	80	80	80	—
Circulation juice after heater	..	89	91	89	80–95
Raw juice to processing	..	45	46	45	41–51

The average temperature of the raw juice passing to purification was 45°C (see Table 4). The press-water temperature was too low at 68°C. In order to achieve effective sterilization, the return water should have a temperature of about 75°C on entering the diffuser. In connexion with this, the press-water carried a considerable amount of sand and the Alfa-Laval heat exchanger (heat exchange against condensate) was frequently blocked. The fresh water temperature was about 8°C. The discarded exhausted cossettes had a temperature of about 20°C (temperature of the press-water flowing from the presses). In Fig. 6 pH values are given together with temperature curves. pH maintenance will be dealt with under "Microbiological tests".

Difficulties may arise if the diffuser is operated at temperatures below 70°C, as often considerable foaming of the raw juice occurs. We could not determine to what extent foam can occur in the diffuser under these conditions or when processing fresh or other beet that produce highly foaming juices. During the tests no troublesome foam occurred when a comparatively small quantity of anti-foaming agent was used. A thin layer of foam did appear on the cossette blanket only for a very short time when operations were interrupted.

(*To be continued*)

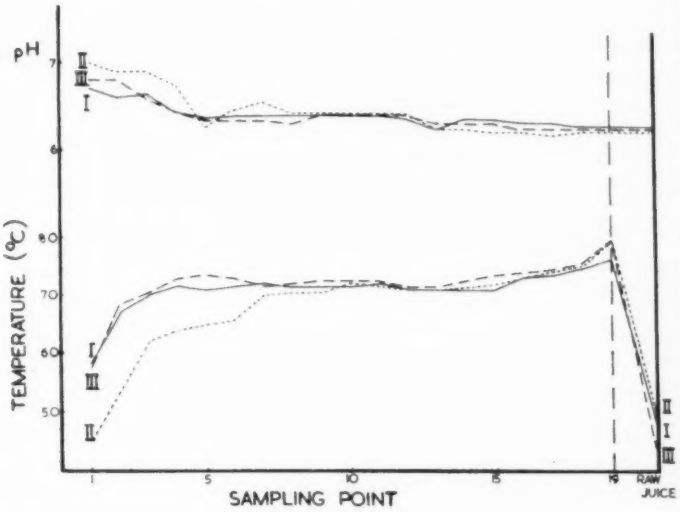


Fig. 6

[2] SCHNEIDER and HOFFMAN-WALBECK: *Zucker-Beihefte*, 1952, 1, 70.

[3] SCHNEIDER and REINEFELD: Technologie des Zuckers. (Schaper, Hannover) 1955. p. 133.

THE NEW DOMINO SUGAR REFINERY

PART I

LOCATED on tidewater in the Charlestown section of Boston, Massachusetts, the new Domino sugar refinery replaces the 100 year-old South Boston plant of The American Sugar Refining Company. It provides excellent facilities for receiving raw sugar and also for truck and rail shipments of refined sugar. The new refinery is the culmination of years of intensive study and experimentation, and, in many respects, includes completely new approaches to the refining of sugar. It was designed for a melting rate of 2,000,000 pounds per day. Operations began in mid-September, 1960.

To achieve the major objectives of minimal construction and operating costs, many design considerations were investigated. Among these considerations

Fig. 1

were building arrangement, outdoor construction, equipment grouping, proper design for maintenance of a high sanitation level, bulk handling of materials and automation.

In line with the basic design objectives, all refining processing, except the adsorption process, is housed in a single building—the Refining Centre. Other adjacent but connecting buildings provide areas for refined sugar storage, packaging, warehousing and shipping, liquid sugar storage and shipping, the Sales, Accounting and Personnel offices, the cafeteria and the first-aid room. The refinery and engineering offices and the refinery laboratory are located in the Refining Centre. Separate buildings are provided for raw sugar storage and for the steam and power generation facilities.

Maximum use of glass and building tile provides an attractive clean appearance and allows easy maintenance. Outdoor planting and extensive landscaping enhance the entire building area.

Many ideas were considered and carefully studied before the final refining system was selected. Some of these ideas were the use of vapour recompression, ion exchange, carbonatation, continuous centrifugal machines, and automatic warehousing. Many of these methods were discarded because the original cost was prohibitive, or because the equipment for carrying them out had not been adequately developed.

In order to obtain economy in both construction and operating costs, the design of each refining unit operation was carefully analysed. Two major decisions affecting refinery design resulted: first, there would be no sweetwater evaporator, and, second, there would be no soft sugar production. In the latter case it was more economical to supply the soft sugar requirements of the new refinery from one of the Company's other refineries. However, ample space was provided in the new refinery for the installation of soft sugar production equipment should future economic conditions justify it.

Each portion of the contemplated refining process was studied for its suitability to outdoor installation since obvious capital savings could thus be made. The recently developed Continuous Adsorption Process (CAP) for decolorization of sugar liquors was most strikingly adaptable to this type of construction. The evaporation and vacuum pan equipment, many pumps, and most of the dry bulk storage bins also could be conveniently installed outdoors.

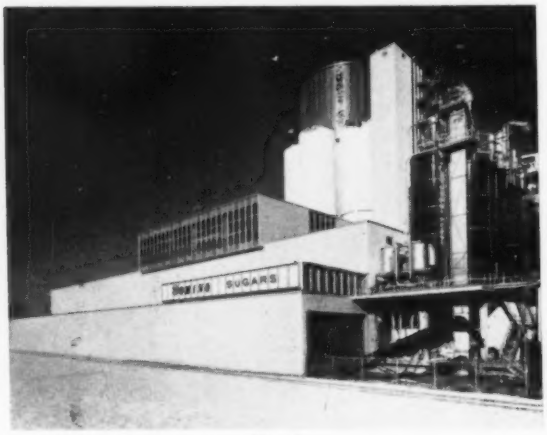
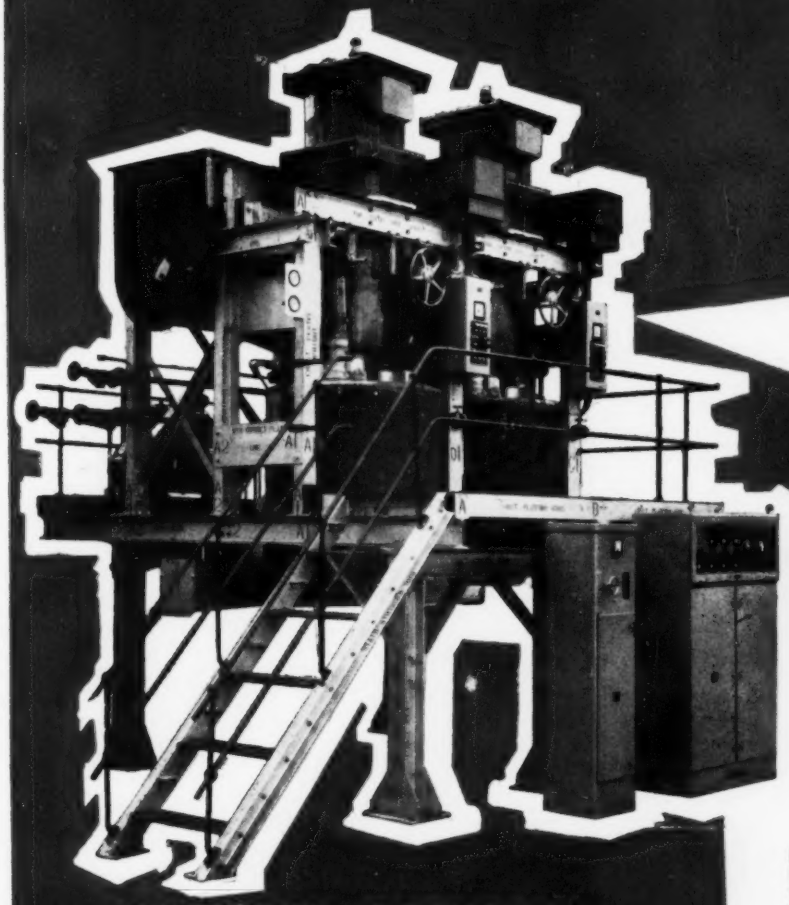


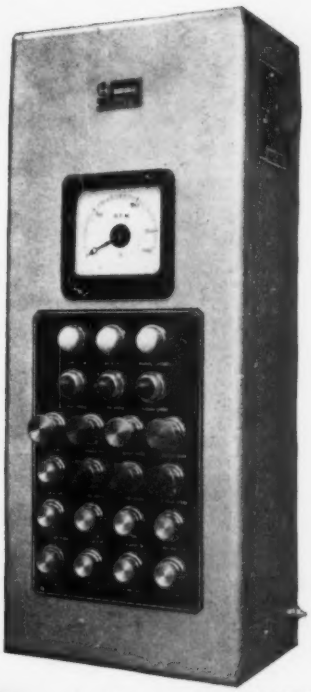
Fig. 2

After the processing steps had been fixed, the equipment best suited to perform each specific operation was selected. The proper combination of machinery and operating method has provided an integrated, rigidly controlled process, leading to the production of consistently high quality products at low operating costs.

Prior to deciding on the detailed design of the refinery, complete material and heat balances on the process were made. A system of 81 equations representing 435 conditions was used to solve the material balances. Each material balance stream was con-

from P&W





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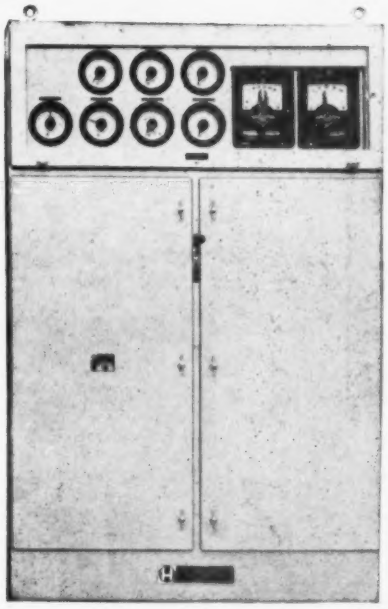

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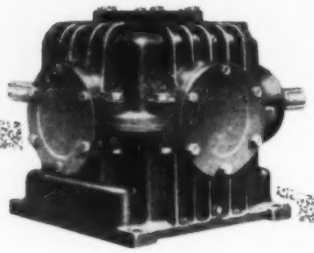

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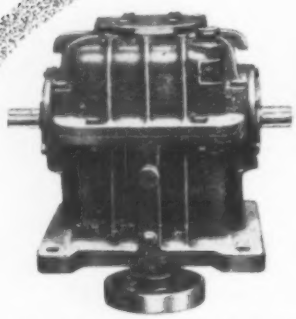

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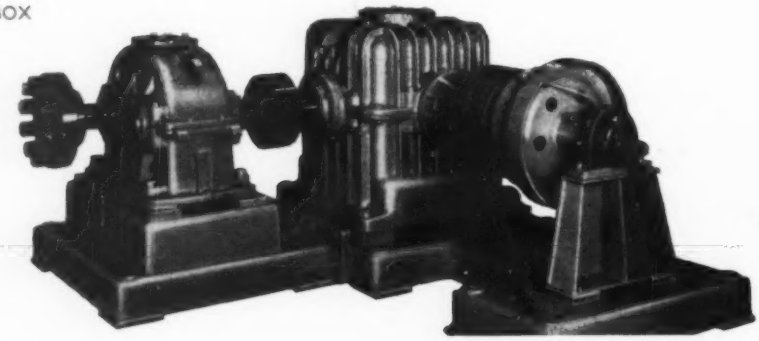

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sidered to consist of three components: sucrose, non-sucrose impurities and water. The solutions of the equations were worked out by an I.B.M. 704 digital computer. Several computer runs had to be made in order to take into account all of the interacting recycling streams.

The layout of the refining process utilizes gravity flow wherever possible to minimize the number of long piping and conveyor runs.

In order to maximize the efficient use of labour to supervise each process step, similar types of equipment are grouped together wherever possible. For example, all the mechanical filters, the clarifiers and the centrifugals are located on one floor. Most of the pumps are arranged on another floor with their respective feed tanks situated immediately above. The granulators are installed directly beneath the centrifugal machines feeding them.

Maximum efficiency of packaging labour was obtained by installing all the packaging equipment on one floor.

All equipment was designed and installed to make plant sanitation easy. All tanks are equipped with overflow lines and alarms, all dust producing equipment is enclosed and is provided with dust collectors and all vapour-producing equipment is enclosed and vented. All pumps are mounted in specially constructed, pitched wells which are self-draining to collecting sumps. Wherever possible, process equipment is mounted flush with the floor with rounded concrete sills. The packing floor is air conditioned, contributing to employee comfort and minimising mechanical maintenance and cleaning.

To take optimum advantage of modern materials handling methods, process chemicals are stored in bulk. Removal from storage and transporting is done by pneumatic and slurry transport systems. Spillage sugar is pneumatically conveyed for reprocessing. Maximum use of palletising is made in the refined sugar warehouse.

Detailed Description of the Refining Process

The heart of the refining complex is a central control room which contains graphic panels showing the process flow and the operation of the major pieces of refinery equipment from the raw sugar warehouse to the refined sugar screening equipment. In addition to indicator lights for pumps, conveyors and other similar equipment, cycle and shutdown alarms for major items of equipment are also mounted on these panels. Indicating-controlling instruments for such critical process variables as solids content, flow rate, pH and temperature as well as for complete process steps such as decolorization and pan boiling are also located here. In the central control room is a data logger which receives and records data on a single sheet of paper from over 200 points throughout the refining process. The data logger, in addition, signals off-normal conditions when they arise, by ringing an alarm and printing the off-normal variable in red.

As the process supervisor operates chiefly from the control room, he is kept constantly informed of process conditions. By means of a selective public address system and an extensive telephone system the process supervisor maintains instant communication with roving process attendants. These attendants are dispatched immediately to any area which may need attention. The attendants report back to the process supervisor thus enabling him to obtain rapidly accurate information on which to base operating decisions.

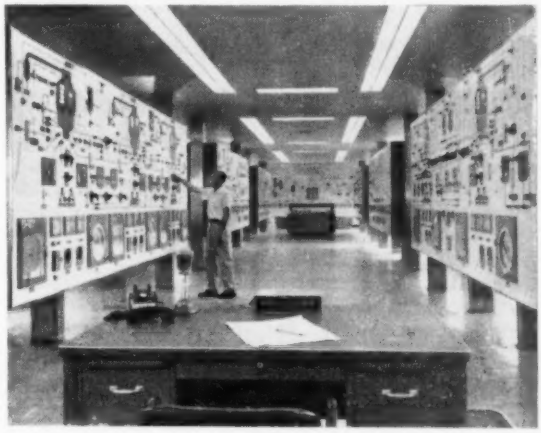

Fig. 3

A separate instrument control panel is provided for the mechanical filtration station since intensive local manual supervision of this operation is imperative to ensure absolute clarity of the sugar liquors prior to further processing.

The refined sugar distribution system is provided with a separate instrument control panel located in the packaging, warehousing and shipping building. It was put here because the distribution system is more intimately tied up with these functions than with the refining process.

Certain other major units, such as the char reactivation kiln and the centrifugal machines, also have locally mounted control panels to enable the area operator to observe and control them.

Nearly all the refinery instrument transmission systems are electrical.

All raw sugar is received in bulk. The raw sugar receiving facilities were designed primarily to receive raw sugar from the "Domino Crystal", a 9500-ton self-discharging motor ship. Raw sugar is discharged from the vessel by means of ship-mounted grabs. These discharge into dockside travelling hoppers which in turn feed the raw sugar belt conveyor through self-contained belt feeders. All discharging and conveying equipment has been designed for a discharge rate of 675 short tons per hour.

The raw sugar is conveyed to a completely automatic receiving scale which weighs approximately 15 long tons of sugar per drop. The net weight of each

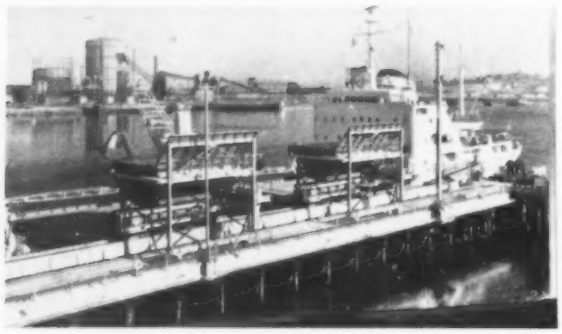

Fig. 4

scale drop is printed on a tape and recorded on counters. The sugar is discharged from the scale into a surge hopper where it is automatically sampled. From the hopper the sugar is conveyed by belt to the 30,000 long ton capacity raw sugar storage warehouse. This warehouse is of parabolic, steel arch, dome construction having a base diameter of 238 feet and a height at the apex of 107 feet. The sugar to be stored is conveyed to the apex of the warehouse, where, by means of a rotating distribution belt, it can be evenly distributed over the entire warehouse area.

Fig. 5

The entire raw sugar discharging and storing system is electrically interlocked so that the malfunction of any component in the system will automatically shut down all the equipment preceding it.

To start the refining process a payloader in the raw sugar warehouse supplies raw sugar to a belt conveyor which, in turn, conveys the sugar to the Refining Centre where the raw sugar is discharged into a surge hopper and a sample is automatically withdrawn. The surge hopper, in turn, feeds an automatic scale. As in the case of the receiving scale, this scale automatically prints the net weight of each drop on a tape and records the net weight on counters. This information is also recorded on the data logger. The melt scale normally weighs approximately 2000 pounds per drop. Sugar is discharged from the scale into another surge hopper, in the bottom of which are located a pair of rollers for crushing any lumps of raw sugar. Upon a signal from the scale hopper, a predetermined dose of affination syrup is metered to the crushing rollers for mingling with each drop of raw sugar. The spacing of the crusher rollers is such that the time required for the sugar to discharge from the surge hopper through the rollers coincides with the time required to meter in the dose of affination syrup. Thus, an even mixing of the raw sugar with the affination syrup is assured.

The level of sugar in the surge hopper before the scale hopper is indicated by lights in both the central control room and in the raw sugar warehouse. By following these indicator light signals, the payloader and control room operators are able to maintain the melt rate of the refinery. Should the level in the surge hopper exceed a predetermined maximum limit, the raw sugar belt conveyor automatically shuts down.

Since the melt scale cycle is electrically interlocked with the level in the lower surge hopper and the level in the raw sugar mixer, high levels in either this hopper or the mixer automatically prevent the scale from starting a discharge cycle. The melt scale is also electrically interlocked with the affination syrup system in such a manner that the affination syrup dosing must be completed prior to the scale starting another discharge cycle.

The magma from the mingler discharges into the raw sugar mixer which in turn feeds fully automatic 48-inch affination centrifugal machines. Affined washed raw sugar drops directly to a premelter scroll and the proper amount of sweetwater is automatically metered in on signal from the centrifugal machines. From the premelter the washed sugar liquor flows to the melter where heating to the desired process temperature is accomplished. From the melter the washed sugar liquor passes over screens to remove fine lint and is pumped to a surge tank.

The cycle timing of the centrifugal machines is flexible and automatically controlled within predetermined limits. The cycle is dependent on the level in the washed sugar liquor surge tank.

The washed sugar liquor melt stream is treated by phosphatation using phosphoric acid and lime saccharate. The rate of acid addition is automatically controlled by the washed sugar liquor flow rate so as to maintain a predetermined ratio of P_2O_5 solids to washed sugar liquor solids through a ratio controller, which varies both the length and the number of strokes per minute of the acid pump. Similarly, lime saccharate addition is automatically controlled by the set point of a pH meter located in the washed sugar liquor stream.

(*To be continued*)

CALCIUM CHLORIDE AS AN AID TO PULP PRESSING

By A. CARRUTHERS and J. F. T. OLDFIELD

Paper presented to the 14th Technical Conference, British Sugar Corp. Ltd., 1961.

PART II

Assessment of the effects of calcium chloride treatment by analysis of pulp and juice

It is no simple matter to measure the precise effects of calcium chloride either on pulp pressing or on juice quality in the factory process. Many other variables, such as the pH and temperature in diffusion, influence pulp pressing efficiency and the composition of the juice does not remain constant even when calcium chloride is not applied. To minimise these variations, it is desirable to measure the changes occurring when calcium chloride is applied for a relatively short period, but such a procedure requires that the calcium chloride should be applied uniformly and at a precisely known rate. This information is not always available and a small unit was therefore constructed for the application of calcium chloride at a predetermined rate.

The unit consisted of two 45-gallon vessels to contain calcium chloride solution. Each vessel was connected to a pump and the majority of the feed from the pump was returned to the vessel to provide stirring. The solution was pumped through a flow meter to the pulp leaving the scroll from the RT diffuser and the flow rate was controlled at 1 g.p.m. One cwt of flake calcium chloride was dissolved in 45 gallons of water in one vessel, while the other vessel was in service to provide a uniform addition of calcium chloride at a rate of 150 lb per hour.

The calcium chloride treatment at the factory was suspended for 12 hours and then samples of diffusion supply water, pressed pulp, pulp press water and second carbonatation juice were taken for analysis at intervals of 20 minutes for a period of two hours. The calcium chloride addition was then commenced and maintained at a rate of 150 lb per hour for 4½

Table 4

Comparison of normal diffusion and diffusion with calcium chloride addition (180 lb/100 tons beet)

Liquor Analysis (p.p.m.)

Treatment	*Time*	*Pulp press water* Ca	Cl	K	pH	*Diffusion Supply water* Ca	Cl	K	pH	*2nd carbonatation Juice* Cl	K	RDS*
Ca off ..	0945	17	40	260	5·79	38	68	100	6·69	163	1200	11·9
	1005	16	70	220	6·08	40	68	140	5·50	183	1250	12·0
	1025	16	23	240	5·85	37	40	150	6·20	190	1300	11·2
	1045	17	52	240	6·00	38	46	150	6·32	188	1300	12·0
	1105	19	63	250	6·10	38	42	160	4·80	194	1300	12·0
	1125	17	93	250	5·79	40	54	140	4·30	171	1200	11·8
Off	Mean	17	57	240	5·93	38	53	140	5·63	181	1260	11·8
Ca on from 1125	1450	179	650	580	5·28	133	280	270	4·28	177	1200	12·0
	1510	138	580	500	5·30	126	410	280	4·25	170	1250	12·0
	1530	133	700	550	5·22	117	310	140	6·50	182	1225	12·0
	1550	174	720	480	5·52	155	400	180	4·70	157	1250	12·0
On	Mean	156	660	530	5·33	133	350	220	4·93	172	1230	12·0

Pressed Pulp Analysis

Treatment	*Time*	*Dry substance %*	*Concentration % dry substance* Ca	Mg	K	Na
Ca Off	0945	17·2	0·49	0·14	0·58	0·12
	1005	18·5	0·50	0·13	0·56	0·11
	1025	17·4	0·50	0·15	0·51	0·10
	1045	18·0	0·49	0·16	0·57	0·10
	1105	18·1	0·49	0·11	0·51	0·09
	1125	17·1	0·51	0·11	0·64	0·11
Off	Mean	17·7	0·50	0·13	0·56	0·10
Ca On .... from 1125	1450	19·3	0·88	0·11	0·41	0·08
	1510	20·0	0·86	0·12	0·47	0·09
	1530	20·2	0·80	0·11	0·38	0·08
	1550	19·2	0·89	0·11	0·38	0·08
On	Mean	19·7	0·86	0·11	0·41	0·08

* Refractometric Dry Substance.

hours. During the last hour, samples were again collected for analysis. Throughout the period, the slice remained constant at 83 tons per hour, so that the calcium chloride addition was equivalent to 180 lb/100 tons beet.

The analytical results are recorded in Table 4.

During the calcium chloride treatment the pressed pulp dry substance was increased, on average, by 2%, from 17·7% to 19·7%. The calcium content of the press water was increased by about 140 p.p.m. and therefore about half of the applied calcium was immediately absorbed by the pulp; the chloride content of the press water was increased by about 600 p.p.m. indicating no preferential absorption by the pulp. The potassium concentration in both press water and diffusion supply water was increased, demonstrating that potassium was desorbed from the pulp. It should also be noted that the make-up water provided an additional source of calcium as is apparent on comparison of the data for press water and supply water.

Though several factors can cause variations of pH in the diffusion system, it appears probable that the reduction of pH of the pulp press water was associated with the calcium treatment. As the flake calcium chloride has an alkaline reaction, the reduction in pH suggests that additional hydrogen ions were produced to maintain ionic equilibrium. The fluctuations in pH, and in the concentrations of the ions in the diffusion supply water, indicate that the proportions of press water and make-up water were not constant during the sampling period.

If the calcium or magnesium content of raw juice were increased by the treatment, these ions would be eliminated in clarification except in so far as the lime salts could be increased by the effect of any associated anions on the available alkalinity. Potassium and chloride were determined in second carbonatation juice, rather than in raw juice, because neither ion is eliminated in clarification and chloride can be determined by direct titration in clarified juice. Although the calcium treatment considerably increased the potassium and chloride concentrations in the water end of the diffusion system, no significant change was observed in the concentrations of these ions in the clarified juice. Since the lime salts and the potassium and chloride concentrations in second carbonatation juice are not constant, small changes in juice quality due to the calcium treatment may not be detectable. Analysis of the dried pulp, however can provide additional evidence since, with complete return of press water, any changes in composition of pressed pulp must be reflected in the juice to process.

180 lb of flake calcium chloride per 100 tons of beet represents 126 lb of anhydrous calcium chloride or 45 lb of Ca per 100 tons of beet. Assuming a dried pulp production of 5% on beet, the calcium addition was equivalent to 0·4% on dried pulp. The mean values recorded in Table 4 show that, as a result of the treatment, the calcium content of the dried pulp was increased by 0·36% and so it is possible to account for 90% of the applied calcium as present in the pulp. It could therefore be estimated by difference that about 10% of the calcium passed into the juice to process but the precision of this estimate is not particularly high since the calcium content of the samples fluctuated considerably. It is clear, however, that the excess calcium in the juice was small.

The calcium chloride addition also reduced the magnesium, potassium and sodium contents of the dried pulp by 0·02%, 0·15% and 0·02% respectively. If the diffuser is operated with a draught of 112%, the changes in composition of the dried pulp are equivalent to increased levels of potassium 67 p.p.m., calcium 18 p.p.m., magnesium 9 p.p.m., and sodium 9 p.p.m. in raw juice. Changes of this order in raw juice cannot readily be distinguished because of the natural fluctuations in juice composition. The largest difference, that of potassium, represents only about 5% of the potassium in raw juice whereas the potassium concentration in thin juice without calcium addition showed natural fluctuations of more than 8%. The magnitude of the changes in concentration, particularly of potassium, in the pulp, however, are such that the effect cannot be attributed to chance fluctuations. Changes in cation concentration in raw juice can therefore be assessed more accurately by pulp analysis than by examination of raw juice samples.

If the additional potassium, calcium, magnesium and sodium ions, calculated to be present in raw juice, were all associated with chloride ions, the additional chloride in second carbonatation juice during the calcium chloride treatment would have been equal to 133 p.p.m., an increase of 73%. If such a change had occurred it would readily have deen detected, since the total range of the chloride measurements for either treatment was less than 25 p.p.m., but in fact the average measured chloride concentration in the clarified juice was 10 p.p.m. less, during the calcium chloride addition. The chloride content of the beet may have changed during the experiment but there was no evidence to suggest that the additional cations in the juice were predominantly associated with chloride ions.

A similar experiment was conducted at another factory where flake calcium chloride was added directly to the diffusion supply water. Two levels of calcium chloride treatment, equivalent to 224 and 112 lb per 100 tons beet, were examined in comparison with diffusion without added calcium. To ensure that equilibrium had been reached throughout the diffuser, measurements were taken on two successive days, once after the calcium chloride had been added continuously for 16 hours before sampling, and on the second occasion after 16 hours without calcium chloride treatment.

The changes in composition of pulp press water and diffusion supply water followed a pattern similar to that recorded for the previous experiment. The mean values for the pulp and thin juice analysis are recorded in Table 5.

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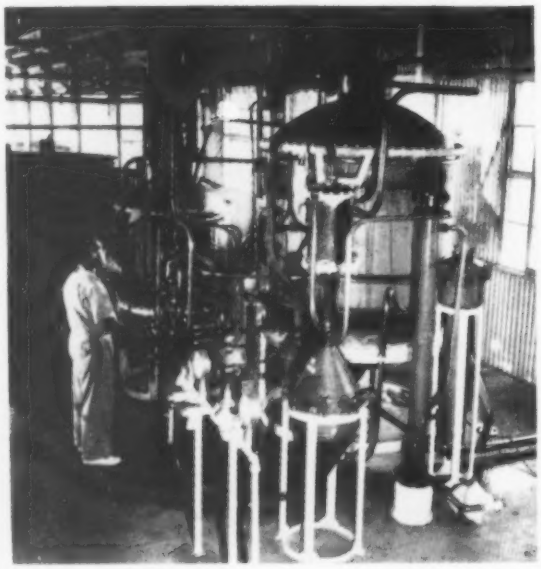

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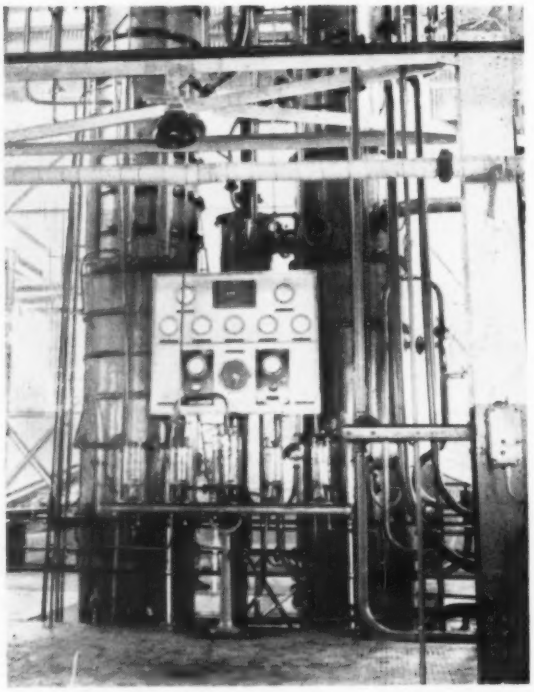

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Table 5

Effects of calcium chloride addition to diffusion supply water

	Calcium chloride addition lb/100 tons beet					
	1st Day			*2nd Day*		
	224	112	0	0	112	224
Pressed pulp analysis:						
Dry substance (%)	18·0	17·9	16·2	15·1	16·1	17·6
Ca % dry substance	1·04	0·90	0·61	0·61	0·86	1·12
Mg % dry substance	0·21	0·24	0·24	0·21	0·20	0·19
K % dry substance	0·28	0·35	0·44	0·45	0·32	0·23
Na % dry substance	0·08	0·08	0·06	0·06	0·05	0·09
Thin juice analysis:						
K mg/100 R.D.S.	1130	1060	1050	1120	1060	1020
Cl mg/100 R.D.S.	206	214	198	188	184	160

The two levels of calcium addition were equivalent to 0·25 and 0·50% on pulp. On the first day the excess calcium measured in the dried pulp was equivalent to 86% and 116% of the nominal calcium addition at the high and low levels respectively. On the second day the excess calcium in pulp at both levels was equivalent to 100% of the nominal addition. Since the flake calcium chloride was dispensed directly from a large hopper, the rate of addition was not known as precisely as in the previous experiment but is is clear that the majority of the calcium can be accounted for in the pressed pulp. The small changes in magnesium and sodium content of the pulp and in potassium content of the juice cannot be assessed because the individual samples exhibited relatively large fluctuations. The potassium content of the pulp, however, again decreased during the calcium treatment and the extent of this change, relative to the calcium application, was of the same order as that recorded for the previous experiment. This relationship for both factories is recorded in Table 6 and the mean effect has been rationalised in terms of an addition of 200 lb $CaCl_2$ per 100 tons of beet.

Table 6

Effect of calcium chloride addition on the potassium content of dried pulp

Calcium chloride addition lb/100 tons beet	*Decrease in potassium (% dried pulp)*	*Decrease in potassium % pulp associated with 200 lb calcium chloride /100 tons beet*
180	0·15	0·17
224	0·16	0·14
112	0·09	0·16
112	0·09	0·16
224	0·22	0·19
	Mean	0·16

It appears that on average the effect of adding calcium chloride to pulp, at a rate equivalent to 200 lb per 100 tons of beet, was to increase the pressed pulp dry substance by about 2% but to decrease the potassium content of the dried pulp by about 0·16%. The latter change is equivalent to an increased potassium concentration of about 0·05 per 100 sugar in thin juice.

Other investigators have tried to assess the effects of calcium chloride on juice quality. BECKER[3] reported a test, carried out at Dormagen, in which the pressed pulp dry substance increased by 1·9% when the calcium content of the supply water was increased for 40 to 200 p.p.m. BECKER assumed that 40% of the calcium chloride would pass into the raw juice and, on calculating the excess molasses production on this basis, he concluded that the process was not profitable. No analytical data was given to support the postulated calcium chloride distribution between pulp and juice and it seems certain that, in the current experiments, very much less than 40% of the calcium chloride, as such, could have passed into the raw juice.

As part of a series of experiments conducted at the Research Laboratories of the Irish Sugar Company, CAROLAN[4] measured a change in potassium concentration in raw juice, produced in a laboratory diffuser, associated with the addition of calcium chloride equivalent to 112 lb per 100 tons of beet. The potassium content of the juice was increased by 0·168 per 100 sugar or 0·027% on beet. CAROLAN calculated that this additional potassium would increase the amount of sugar remaining in molasses to such an extent that the lower white sugar yield would outweigh the benefit of the lower pulp drying costs even without considering the cost of the applied calcium chloride.

To increase the potassium content of juice by 0·027% on beet, however, would require that the potassium concentration in dried pulp be decreased by about 0·54%. In the present series of experiments the total potassium in dried pulp without calcium treatment was only 0·56% and 0·45% at the two factories and the decreased potassium concentration associated with 112 lb of calcium chloride was only about 0·1%. If the diffusion conditions were less efficient, so that more potassium remained in the untreated pulp, it is possible that the calcium treatment could increase the potassium concentration in juice to a greater extent, but it appears that, at the factories examined in this report, the potassium effect was much smaller than that found by CAROLAN

Economics of calcium chloride additions

The cost of calcium chloride, when applied at levels of about 200 lb per 100 tons of beet, represents a considerable proportion of the potential saving in the coal used for drying pulp. Some factories have used flake calcium chloride in air drying plants for sugar conditioning. At factories where such drying equipment is not required, some saving may be obtained by purchasing calcium chloride in solution. Calcium chloride solution containing 36% $CaCl_2$ is available and the delivered cost per ton of $CaCl_2$ is about 10% less than the corresponding cost for flake calcium chloride containing 71% $CaCl_2$. Furthermore the use of the solution would be expected to reduce handling costs and facilitate uniform application to the pulp. If the pulp driers are not capable

[3] *Zucker*, 1955, **8**, 381; *I.S.J.*, 1956, **58**, 169.
[4] *Irish Sugar Co. Research Laboratory Rpt.*, 1957, (37); *I.S.J.*, 1958, **60**, 304.

of drying the entire production of pressed pulp and there is no economic market for the excess pressed pulp, any increase in dry substance in pressed pulp will be reflected in an increased daily production of dried molassed pulp if the coal consumption remains constant. Under these circumstances the value of the additional molassed pulp is far greater than the cost of the calcium chloride treatment.

At factories where all the pressed pulp can be dried without calcium chloride addition, however, the costs of the calcium chloride treatment can only be offset by the reduction in coal consumption by the pulp driers. If the pressed pulp dry substance were increased from 17% to 19% at a factory processing 3,000 tons of beet per day, the quantity of water to be evaporated in the driers would be reduced by about 93 tons per day. Assuming that 8 tons of water can be evaporated per ton of coal, costing £5. 10s. 0d. per ton, the value of the saving in coal would be about £64 per day. If the increase in dry substance was brought about by use of 200 lb of flake calcium chloride per 100 tons of beet, a daily total of 2·7 tons of calcium chloride costing about £45 would be required. The saving in coal, less the cost of the calcium chloride, would therefore be only £19 per day and there would clearly be little margin to allow for any reduced sugar yield due to deterioration in juice quality.

The minimum effect of the calcium chloride treatment, as deduced in section D, would be to increase the potassium content of the thin juice by 0·05 per 100 sugar. If the potassium is associated with an anion which is not eliminated in clarification, the excess potassium salts, equivalent to at least 0·1 per 100 sugar, would increase the molasses production by 1·3 tons and decrease the white sugar yield by 0·65 tons. The decreased revenue due to this change would be about £10 per day at British prices, even though the present difference between the value of white sugar and sugar in molasses is small.

The above calculation of the effect of the excess potassium on sugar yield is based on the assumption that the purity of molasses would remain unchanged; that is, the sugar in molasses would be increased by 3 lb for each additional lb of potassium. This may seem to be a conservative estimate as it is frequently assumed that 1 mg. atm of potassium is equivalent to 0·8–1·0 millimoles of sugar in molasses, i.e. 7–9 lb of sugar in molasses for each lb of potassium.

The authors do not agree with this latter assumption, as recorded previously[5], but whatever the true basis of molasses production it is clear that no substantial overall saving can accrue, by addition of 200 lb of calcium chloride per 100 tons of beet, unless the moisture content of the pressed pulp is decreased by considerably more than 2%. As the use of improved presses leads to more efficient pulp pressing an even greater change in dry substance will be required for economical use of calcium chloride because the coal saving for each 1% increase in dry substance becomes successively less as the dry substance increases.

Summary

Although the treatment of exhausted cossettes with calcium chloride equivalent to about 30 lb per 100 tons of beet does not produce any marked improvement in pulp pressing efficiency, application of some 200 lb of calcium chloride per 100 tons of beet is associated with a significant increase in presssed pulp dry substance.

The effects of high levels of calcium chloride on pulp pressing, and on juice quality, have been examined. Absorption of calcium by the pulp is accompanied by desorption of potassium, magnesium and sodium from the pulp. It is demonstrated that changes in concentration in raw juice as a result of the calcium treatment can be assessed more accurately by analysis of exhausted pulp than by examination of the raw juice.

It is considered that the effects on pulp pressing may be more apparent if the normal make-up water has a low calcium content and that the effects on juice purity may be greater if cossettes are not exhausted efficiently in normal diffusion. At the two factories where tests were undertaken, it was found that more than 90% of the applied calcium was absorbed by the pulp but at the same time the potassium content of the pulp was significantly decreased.

It is concluded that the average effect of calcium chloride, at a level equivalent to 200 lb per 100 tons of beet, was to increase the pressed pulp dry substance by about 2%, but to decrease the potassium content of the dried pulp by about 0·16%. The latter change is equivalent to an increased potassium concentration of about 0·05 per 100 sugar in thin juice.

The calculated changes in juice composition, associated with the calcium chloride treatment, are much smaller than the changes suggested by other investigators. Nevertheless, the most conservative estimate of the effect on white sugar yield of the additional ions in thin juice is such that, when considered purely as a means of saving coal, no substantial overall saving can accrue, by application of 200 lb of calcium chloride per 100 tons of beet, unless the moisture content of the pressed pulp is decreased by more than 2%.

Acknowledgments

The authors wish to acknowledge the assistance which they have received from all of the staff of the Research Laboratories who co-operated in the experiments described in this report.

Burma sugar expansion[6].—The Planning Advisory Committee in Burma has recommended the establishment of several new industrial concerns in that country including a sugar factory with an annual output of 30,000 tons, according to the Export Services Branch of the Board of Trade. Three factories are already in existence in Burma and these with the expected outturn from the proposed factory should enable self-sufficiency to be attained.

[5] CARRUTHERS & OLDFIELD: XI Assemblée, C.I.T.S., Frankfurt, 1960.

[6] C. Czarnikow Ltd., *Sugar Review*, 1961, (516), 126.

Processing of raw cane sugar. B. TOMCZYNSKI. *Gaz. Cukr.*, 1961, **63**, 41–43.—A two-boiling scheme adopted in Polish factories for processing of imported raw cane sugar is described and factory results are tabulated.

* * *

Studies on the sugar cane at Cukurova. H. NOURUZHAN. *Seker*, 1961, **10**, (38), 3–14.—A tabulated account is given of trials using imported cane varieties at Cukurova (Adana, Mersin), with details of yields and analyses of juice, sugar, molasses, etc.

* * *

Sugar factory pollution abatement programme in Louisiana. R. A. LAFLEUR. *Sugar J.* (La.), 1961, **23**, (9), 17–18, 32.—Measures adopted by cane mills to prevent river pollution include: ponding of cane wash water, waste alkali and acid, and acid wash and rinse water; improved factory maintenance; and the installation of entrainment mist eliminators. BOD values of water discharged into various rivers since 1954 are tabulated and show a marked decrease up to 1958.

* * *

Productivity in the sugar industry. R. MARTINEZ P. *Bol. Azucar. Mexicano*, 1960, (Aug.), 31–34; through *S.I.A.*, 1961, **23**, Abs. 3.—The sugar production per man, per hour, and per man-hour in the Mexican sugar industry during the 1957/58 campaign was investigated. With exclusion of the administrative personnel, the average production was 58·2 tons per man. The productivity of the five largest factories (>50,000 tons output, accounting for 37% of the total production) was on the average 89·4 tons/man, the maximum being 251·5 and the lowest figures being 52·2 and 39·1 tons/man. In the second group of 11 factories (20,000–50,000 tons) the average was 65·7 tons/man; the extreme values were 95·2 and 44·1. In the following group (10,000–20,000 tons) of 14 factories, the figures ranged between 116·1 and 61·0 tons/man. Finally, in the three groups of 40 factories with an output below 10,000 tons, of 27% of the total sugar production, figures between 65·1 and 0·9 tons/man were noted. The production per man-hour in the 22 white sugar factories ranged from 73 to below 24 kg; in the raw sugar factories this figure varied from 58 to below 24 kg. The figures of the two largest co-operative factories in these groups are 13 and 17 kg respectively. The figures per man-hour for factories, in order of output, decreased from 24 kg for those with a production of over 50,000 tons to 11 kg for those with a production below 5,000 tons. The production per hour in the individual factories was on the average 7,771 tons. The largest group showed differences from 40,604 to 15,504 tons. The factors concerned in these differences in output are discussed.

* * *

Diffusion process for sugar extraction. ANON. *Chem. Processing*, 1960, **6**, (5), 60–61.—The semi-commercial Chemetron cane diffusion plant[1] at Fellsmere, Florida, is briefly described with a flow diagram. The diffusion juice has a Brix similar to that of mixed juice obtained by milling, and a higher purity (by 1–3%); extraction at 96% is better than with milling and capital and sunning costs are lower. Bagasse is pressed for use as fuel.

* * *

Effect of carbonatation temperature and amount of lime added on carbonatation juice composition when processing raw cane sugar. A. K. GOPAK and G. P. PUSTOKHOD. *Sakhar. Prom.*, 1961, (3), 14–15.—Laboratory tests were conducted on a 50 Bx solution of raw sugar of 96·8% sucrose content and 0·40% invert content which was limed during 10 min at 55 and 85°C with amounts of from 2·0 to 3·5% lime on weight of raw sugar. Carbonatation to 0·02% CaO alkalinity lasted 20 min. In all cases better results were achieved at 85°C, the invert content being 6–7 times lower than at 55°C. Highest purity was obtained at 2·5–3·0% lime. It is pointed out by the editor that decomposition of invert at high temperatures increases juice colour and causes a high lime salts content and that presence of invert helps to increase sucrose recovery.

* * *

Clarifying capacity of active carbons of Soviet production. M. M. LOMANOVA. *Sakhar. Prom.*, 1961, (3), 16–18.—Details are given of laboratory tests, in which artificial syrups were treated with three types of activated carbon of Soviet origin, to determine the purification efficiency and minimum usage.

* * *

The effect of circulation rate on scale deposition in evaporators. I. N. ZASYAD'KO and N. YU. TOBILEVICH. *Sakhar. Prom.*, 1961, (3), 20–28.—Tests were carried out using an experimental unit consisting of three 30-mm dia. single-tube evaporators, 3 m long. The circulation rate of the juice varied within the range 0·055–6·4 m/sec, while the heat flow remained constant at 19,000 kcal/sq.m./hr. Sugar solutions of 15–60% concentration were evaporated. Results show that with increase to a rate of 1·5 m/sec, the amount of scale deposited on the heating surface was reduced, while increase beyond this had little

[1] *I.S.J.*, 1955, **57**, 382.

further effect. The reducing effect is ascribed mainly to an increase in the "economizer" section of the tube, where scale deposition is slight, while the boiling zone, where intensive scale deposition occurs, rises to the top of the heating tube or is carried beyond the end of the tube. A circulation rate of 0·35–0·13 m/sec is recommended, dependent on evaporator effect, as being that rate at which the boiling zone will be extended beyond the heating tube and at which the scale will be reduced by 50%. If the economizer section covers $\frac{2}{3}$ of the tube length, the evaporator will be able to function for a longer period (by 30%) before boiling-out; this can be done by raising the level of the juice above the heating tube to 100%.

* * *

Refining raw cane sugar. R. BRETTSHNEIDER. *Sakhar. Prom.*, 1961, (3), 34–40.—Refining raw cane sugar is discussed generally and compared with the refining of raw beet sugar. The carbonatation method of syrup purification is described with a flow sheet as well as affination and the use of pulverizers.

* * *

Fall in the intensity of heat transmission with foaming of products. V. T. GARYAZHA. *Sakhar. Prom.*, 1961, (3), 47.—Tests with raw syrup have indicated that foam formation causes a severe drop (by approximately 2·6 times) in the heat transfer in evaporators and vacuum pans. This will distort the results of tests and should be checked.

* * *

A scheme for processing Ukrainian kieselguhrs to obtain filter powders. N. A. BUZYKIN, I. A. PRIKHOD'KO and V. S. FURS. *Sakhar. Prom.*, 1961, (3), 48–50.—Full details are given of the scheme which is suitable for Ukrainian kieselguhr which has a particle size up to 1 micron and a hygroscopicity up to 15%. The second grade is obtained from natural kieselguhr by clarification and washing with subsequent drying to 15% moisture content, and the first grade is obtained by calcining some of the second at 600–800° C.

* * *

Pilot plant clarification experiments with new canes during 1960 season. W. F. GUILBEAU, E. E. COLL, C. A. FORT, J. T. JACKSON, and L. F. MARTIN. *Sugar J.* (La.), 1961, **23**, (10), 18–21, 36.—Clarification tests were conducted on CP 44-101 (standard cane variety) and on CP 52-68, CP 53-1, CP 31-13 plant and 1st year stubble cane. Results are discussed for each cane in detail, the values being based on the juice from CP 44-101. CP 52-68 yielded juices with a clarity only 76·5% of the standard, but 11·1% better as regards precipitate quantity. CP 53-1 yielded a juice of 31% clarity and a precipitate amount slightly less than %90. CP 36–13 (only plant cane was yielded a juice of 36% clarity. CP 53-1 is expected to prove, for simple liming, at least equal to the standard and CP 52–68.

What causes rapid deterioration and destruction of blackstrap molasses? G. FROMEN and E. BOWLAND. *Sugar J.* (La.), 1961, **23**, (10), 28–32.—The authors' explanation of the cause of molasses deterioration at Central Fajardo[1] has been considered unsatisfactory by G. T. Reich, whose views the authors analyse, submitting that these fail to refute their original explanation.

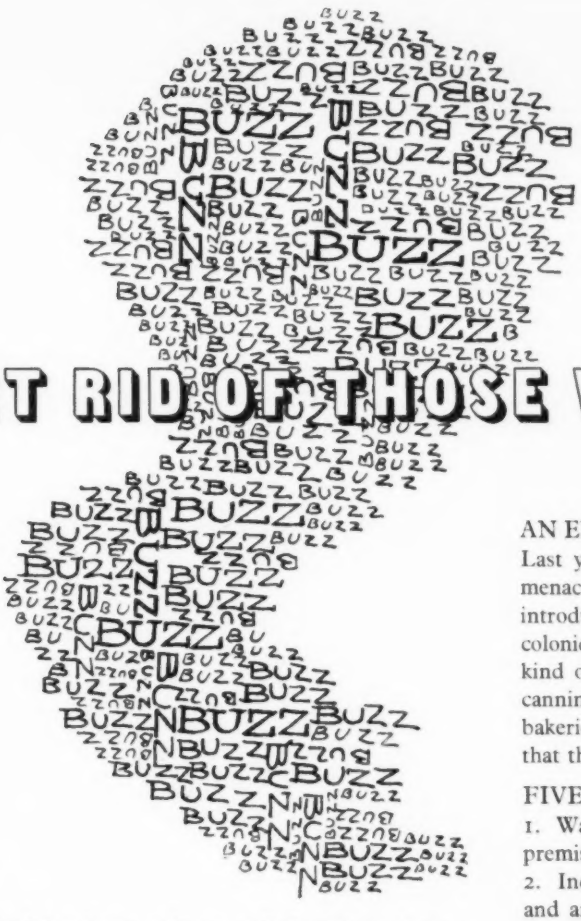
* * *

Effect of an increase of CaO in clear juice on the manufacture of sugar. P. HONIG and F. DE MIGUEL. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 35–41.—Lime serves two purposes in clarification: it removes, in the form of insoluble Ca compounds, various inorganic non-sugars such as phosphate, silicate, etc., as well as high M.W. organic non-sugars such as pectins, proteins. It also neutralizes inorganic acids present. Taking the average phosphate content of mixed juice as 200–250 mg/litre, this requires 250–350 mg/litre of CaO for its removal. About 50 mg/litre CaO is precipitated as silicate, etc. Additional CaO added remains in solution and sometimes attains 400 mg/litre. This is harmful, leading to increased scaling of heating surfaces, high ash in sugar and finely-divided precipitates in the final molasses. Control is thus necessary to avoid excess use of lime and pH is suggested as a suitable variable. The pre-set pH should be a flexible criterion, however, depending on the phosphate content of the mixed juice, and will normally lie between 7·5 and 7·8. The effect of Mg present is mentioned. It usually makes little difference to the clarification at normal pH, its salts being more soluble than those of Ca, but when the pH is brought to 8·5, it is precipitated as phosphate. The use of the Ca:Mg ratio as an index of good clarification is discussed, and tables of Ca and Mg analyses in juice, scale and molasses are presented. The importance of good quality milk-of-lime is emphasized.

* * *

Steam economy calculations. F. GARCÍA LÓPEZ and J. A. CLARK. *Mem. XXXIII Conf. Asoc. Técn. Azuc Cuba*, 1959, 43–52.—A series of sixteen evaporation systems have been studied and are presented in a diagram form, giving a limited amount of information on each. They range from a triple-effect evaporator with no vapour bleeding and live steam used in the heaters (using 38,150 lb/hr of steam for 100,000 lb juice per hr) to a combination of a triple-effect pressure evaporator using 20 p.s.i. steam and bleeding to the heaters, together with a quintuple effect without bleeding (using 22,450 lb/hr of steam). These and the fourteen intermediate systems indicate the possibilities of economizing in steam, particularly where utilization of bagasse is envisaged.

[1] *I.S.J.*, 1956, **58**, 72.



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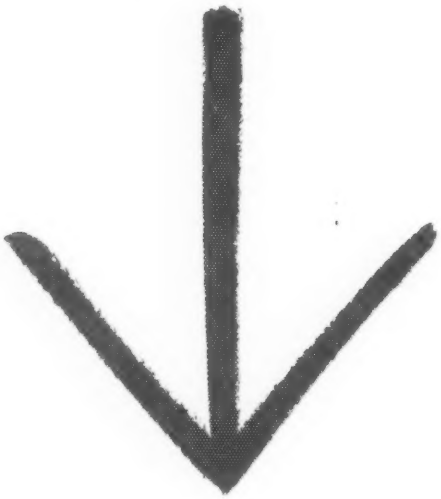

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White sugar from juice. A. RUBIO BARÓ. *Mem. XXXIII Conf. Assoc. Técn. Azuc. Cuba*, 1959, 53–56. It is proposed that juice be brought to pH 3·5 at ambient temperature using phosphoric acid; it is immediately limed to pH 7–7·5 when precipitation of calcium phosphate occurs. This is separated by means of a solid basket contrifugal giving a clear juice which is heated to 212–220°F, evaporated, crystallized and exhausted as usual. The absence of colour formation on heating under alkaline conditions results in a white sugar of 99·1 pol, 0·038% moisture and 0·015% ash, i.e. of comparable quality to refined sugar. The cachaza is better exhausted and drier than usual, allowing higher sugar recovery. In addition, its preparation in the cold means that it yields 18–20% more wax than usual. The extra cost of chemicals is more than covered by the increased recovery.

* * *

The utility of a pilot plant for direct determination of the industrial behaviour of cane of different kinds. L. R. BLISS. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 57–64.—An account is given of the pilot plant sugar factory of Louisiana State University, operated by the University and the Southern Regional Research Laboratory of the USDA. The fields of investigation possible with the plant are described, and it is proposed that similar facilities be established in Cuba.

* * *

The "Pena" clarifier. U. VILLAR LORENZO. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 65–71.—An illustrated description is given of the "Pena" clarifier which is in the form of a cylindrical tank, divided into independent compartments by horizontal plates. Along a radius of each plate is a trough containing a scroll conveyor for muds, individually separable from the common drive by means of a dog-clutch. Juice feed is central and clear juice is withdrawn from the peripheries of each compartment. Mud is carried to the troughs by rakes mounted on arms carried by the rotating central shaft. The clarifier is provided with a foam separator. Advantages of the design are discussed.

* * *

Ideas for future milling plants. J. DÍAZ COMPAIN. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 73–75.—Past experience and numerous tests have indicated, *inter alia*, the importance of defibration and the high proportion of total extraction achieved at the first mill. The author foresees the development of a tandem to a set of knives and shredder, followed by "multiple crushers" and, finally, an extra-heavy 3-roller mill preferably having independent pressures at each compression. The "multiple crushers" are 2-roller mills which are recommended because of their simplicity of maintenance and other advantages.

A gear-driven portable hoist. U. VILLAR LORENZO. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 77–86.—An account is given, with illustrations, of a simple portable hoist constructed at Central Zaza, together with an improved hoist constructed at Central Ramona. It will lift up to 2½ tons and is provided with wheels fitted with roller bearings and car-type steering. The hoist may be moved by two men, laden or unladen, and has found so much use that it is recommended that one unit be constructed for use only in the engineering workshop and another for general use elsewhere.

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Air in the vacuum system. R. BASTANZURI BUJONS. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 87–91.—From the difference between actual vacuum achieved (27 inches ≡ 1·4298 p.s.i.a.) and that corresponding to the condenser water temperature of 107°F (1·1683 p.s.i.a.), it is calculated that while 467 lb/min of steam pass to the condenser-ejector, air leakage amounts to 0·358 lb/min or 2385 c.f.m. The capacity of vacuum equipment is usually well beyond that needed for removal of incondensable gases. Thus if the equipment appears inadequate, attention should be paid to leaks rather than to increasing capacity. A particular point for attention is at the steam jet ejectors.

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Smoke from sugar factory chimneys. J. DÍAZ COMPAIN. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 93–96.—The dangers of "smog" pollution of air are discussed and reference made to the desirability of achieving clean air by use of equipment designed to remove entrained bagacillo and carbon particles in the gases leaving the sugar factory chimney. These are stated to be 0·7–2 grains per cu. ft. compared with 0·29 grains as laid down in the A.S.M.E. Boiler Code. van Tongeren-type double-action cyclone separators will remove 98–98·5% of these solids; while electrostatic precipitators will reach 99% efficiency, the cost is 3–5 times greater.

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Deduction and discussion of an integral formula which permits the calculation of the work opening at the discharge of a mill. U. VILLAR LORENZO. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 97–104. The settings of a mill must be pre-set by the factory superintendent and will vary with mill conditions. The necessity of correct setting is particularly important in the case of the turnplate, the position of which cannot be substantially altered after its initial setting. While the judgment of the superintendent is based largely on his experience, the starting point must be values obtained using theoretical formulae. Such formulae are developed and take into consideration as many factors as possible which affect the mill settings. The practical results of mill operation will show whether the settings calculated are the most appropriate.

Application of the integral formula which permits calculation of the work opening at the discharge of a mill, and obtaining auxiliary graphs. U. VILLAR LORENZO. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 105–114.—The formula derived previously (*cf.* previous abstract) is used to provide tabulated data in a specific example, together with graphs of the changes resulting from variation in roller peripheral speed and bagasse fibre content.

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Control charts of the velocities of milling tandem engines as a function of the quantity of cane to be milled. U. VILLAR LORENZO. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 115–122.—If the settings of a milling tandem are correct and the quantity of cane to be milled is increased, the settings can best be maintained by increasing the mill and so the engine speeds. This tends to be a rather inaccurate procedure and it is recommended, therefore, that graphs be prepared, relating the engine speeds to the weight of the cane crushed. Such graphs, kept near the mill, will enable the operator to select the proper speed appropriate to the tonnage being crushed at any moment.

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Analytical study of the cane milling process. M. A. SUÁREZ CARREÑO. *Mem. XXXIII Conf. Asoc. Técn. Azuc. Cuba*, 1959, 123–131.—By mathematical examination of the two stages in milling referred to earlier[1] (i.e. extraction of absolute juice and extraction of "diluted "juice) the author concludes that the total maceration must be at least four times the absolute juice delivered in the first stage; in the first stage it is the greatest sum of individual efficiencies which is important, regardless of their order or differences; minimum imbibition necessary will be less with increasing fibre gradient; the maceration water for a given imbibition will thus be greater for a greater fibre gradient; to calculate the ideal fibre gradient it is necessary to determine the minimum fibre which can be fed to a mill without slipping; in all cases it is better to wash more and dry less, even though this means a larger mill opening than otherwise; and in spite of the fact that mathematical analysis cannot allow for mechanical deficiencies, it is the best method for milling study. A note on practical application of such analysis is provided as an appendix.

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First continuous centrifugal in operation in the Philippines. F. R. GEMPERLE. *Sugar News* (Philippines), 1961, **37**, 19–21.—A BMA continuous centrifugal has been in operation at Central Pilar since September 1960. The quantity of crushed grain has been found to be insignificant and no obstacle to production of uniform grained sugar. Advantages of the machine are discussed.

Improved two-boiling system. G. FUNDORA and M. A. MASCARÓ. *Sugar y Azúcar*, 1961, **56**, (3), 33–34, 43 See *I.S.J.*, 1961, **63**, 115.

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The first independent sugar refinery in Central America. G. O. WINTER. *Sugar y Azúcar*, 1961, **56**, (3), 36–37. See *I.S.J.*, 1960, **62**, 352.

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SF system: Double grain-holder for third footings. Its advantages in the boiling house. J. M. SALINAS. *Bol. Ofic. A.T.A.C.*, 1960, **19**, 504–507.—The system, adopted at the end of the 1959 season and for 1960, employs a pan having an individual condenser and Honeywell controls which is provided with syrup and seeded with powdered sugar. The pan is then boiled using first molasses and 600 cu. ft. of the 900 cu. ft. contents discharged to a grain-holder. The pan is then built-up again with 1st molasses and half discharged to a second holder. The pan is built-up with 2nd molasses to give the 3rd strike. Advantages include more control of the final massecuite and better uniformity; less recirculation of 1st molasses; lower viscosity and better purging of final massecuite; higher proportions of first and second massecuites, so aiding the centrifugal station; and less seeding and low stocks of materials in the pans.

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Application of automation in the sugar industry. F. CORDOVEZ Z. *La Ind. Azuc.*, 1961, **66**, 95–96.—Advantages of automation compared with manual operation are briefly discussed as are the principal variables lending themselves to such treatment. An account is given of some of the examples of automation existing in the sugar industry.

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National Gur Institute helps gur and khandsari industries. ANON. *Sharkara*, 1960, **3**, 162–167.—The basic problems of the gur and khandsari industries are discussed and the improvements in the processes and equipment brought about by the Sugar Research and Testing Station are described.

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Designs and new features of sugar factories exported by Czechoslovakia. M. ŠKRÁBAL. *Czechoslovak Heavy Ind.*, 1961, (5), 32–43.—A detailed survey is presented of beet and cane factory and refinery equipment produced in Czechoslovakia. Exports of factories date from 1870 and number at least 500.

[1] *I.S.J.*, 1959, **63**, 85.

BEET FACTORY NOTES

Electric drive for the high-speed PN-1000 centrifugal. N. R. FREPON. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1960, **8**, 186–199.—Full details are given of the electric drive of the PN-1000 centrifugal for middle and final product massecuite[1]. Its advantages are enumerated. Regenerative braking results in large cuts in power consumption.

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Continuous boiling of massecuites. V. M. VOLOKHVYANSKII. *Sakhar. Prom.*, 1961, (2), 12–15.—The continuous boiling of massecuite in a sectioned pan will be more regular as the number of sections is increased; with few sections (e.g. five) the retention time of the massecuite in each section will vary, resulting in a mixture of large and small crystals in the final massecuite. Thus the ideal type of continuous vacuum pan is a long, narrow horizontal pan having many narrow sections. Automatic control of the boiling in each section would be preferable, although regulation of the final massecuite Brix by means of syrup and vapour feed control would meet the minimum requirements. The thickening-up and crystal growth must be slow to maintain equilibrium between water evaporation and sugar crystallization. This is possible with a method proposed by SILIN, whereby a small agitator would be immersed in the massecuite and the low current required to drive the motor would be used for automatic control of the syrup or steam valves. A diagram is presented of a proposed horizontal pan. The heating surfaces are hollow segments of discs (various shapes are possible) at right-angles to the pan axis. The stirring device is in the form of a comb, the teeth of which rotate on the horizontal shaft through the hollow discs and so stir the massecuite and simultaneously remove any deposit from the heating surfaces. The upper half of the pan contains baffles, which are extensions of the disc walls, and which prevent mixing of the massecuite along the horizontal surfaces. Massecuite flow is through slots at corresponding points in the baffle plates and the discs. The agitator is preferably included in that part of the pan where the massecuite is denser, as its effectiveness increases with Brix and purity. The height of the discs should be reduced gradually from the head to tail of the pan for ease of massecuite flow. A final note is given on the heat transfer coefficient and on density, which will gradually increase from that of the incoming syrup to that of the final massecuite, compared with the process in a batch pan, where the Brix of the massecuite will be almost uniform throughout and roughly the same as the final massecuite Brix.

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Forced ventilation of beet in piles. V. T. SADKOVSKII. *Sakhar. Prom.*, 1961, (2), 34–38.—Known methods of forced ventilation of beet piles suffer from one defect, viz. the air stream does not flow evenly through the pile but tends towards an upward path. This results from the fact that the total area of outlets in the main air feed is far smaller than the total area of the air outlets in the pile itself. A device for use with a pile of grain has been adapted for beet piles and gives an approximate guide to air flow velocity. It is a bottomless 550-mm dia. iron tube with a conical hood on which is placed an anemometer. The tube is placed in the top of the pile and the air speed indicated by the anemometer is converted by means of a formula which takes into account the height of the pile and the density of the beet. Empirical formulae are derived for calculation of the resistance of the beet to air flow, based on the height of the pile, the air flow rate, air density and "porosity" of the pile. The resistance is shown to be so slight that it may be ignored in aerodynamic calculations.

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Nomograms for curing of 2nd (final) product massecuites. YU. D. KOT. *Sakhar. Prom.*, 1961, (2), 16–21.—Four nomograms are presented based on the author's formula[1] for calculation of the molasses: sugar weight ratio in the massecuite to be spun. These give the required time of spinning for a yellow sugar of required purity, grain size and molasses content. The nomograms apply to intercrystalline viscosity of 45–60 poises and are intended for use with three types of Soviet centrifugals. Examples are presented showing how to apply the nomograms. Increasing the average grain size (by use of pan seeding) has resulted in considerable improvements in spinning of the massecuites. The working part of the spinning cycle has been reduced by 20%, the yellow sugar purity has risen by 1–1·5% and the final molasses purity fallen by almost 2%.

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Transfer of molasses and beet pulp with a pump designed by NIIMESTTOPProm. V. A. SILIN and E. YA. DUBROVSKII. *Sakhar. Prom.*, 1961, (2), 28–30.—A diagram is presented of a Soviet vane pump which has a capacity of 39–34·2 cu.m./hr of pulp diluted 1:1 or 47·0 cu.m./hr of cold undiluted molasses. It will operate against a head of up to 70 m.

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The behaviour of pectin with the return of 1st carbonatation juice and the rôle of this process in production. K. D. ZHURA. *Sakhar. Prom.*, 1961, (2), 38–40.—Tests were carried out to determine at what concentration of pectin in 1st carbonatation juice the return of the juice will be sufficiently effective in filtration. Pectin (0·05–0·3% on juice) was dissolved in hot water and added to pure sugar solutions. These were then heated to 85°C and treated with 2% CaO with and without juice return (1:1). All samples were saturated to 0·08% CaO alkalinity and filtered at 80°C and 1 atm pressure until 1 mm cake was formed.

[1] *See I.S.J.*, 1959, **61**, 247.
[1] *I.S.J.*, 1959, **61**, 372.

The filtration coefficients and the corresponding pectin concentrations were used to draw a graph which shows that the filtration rate falls with increase in the pectin content with or without juice return, although the rates coincided only at 0·3% pectin. The limit after which juice return ceases to be beneficial to filtration is 0·2%. Similar tests with raw juice samples with 1:1 return showed that after the second return of juice the filtration rate was almost stable, thus indicating that any rise in the filtration rate with juice return is caused by coagulation of mud particles. After purification of raw juice, pectin distribution was 30% in juice and 70% in the muds. After a second defecation, the corresponding figures were 64·2% in juice and 35·8% in muds. To this transfer of the pectin from the muds is ascribed any improvement in the filtration with juice return; the sugar losses to molasses are greater, however, although this may be avoided by returning 2nd carbonatation instead of 1st carbonatation juice and liming with 0·3–0·5% CaO at 2nd carbonatation.

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A simplified and accelerated juice purification scheme. Z. D. ZHURAVLEVA and F. N. DOBRONRAVOV. *Sakhar. Prom.*, 1961, (2), 48–49.—Laboratory tests with factory juices were conducted on a juice purification scheme with progressive pre-liming and instantaneous defecation[1], the results of which are compared with those obtained by the normal scheme with return of 1st carbonatation juice to pre-liming and 8–10 minutes' main liming. The factory pre-limed juice was subjected to instantaneous liming with 2·5% CaO on weight of beet, carbonatated immediately afterwards to optimum alkalinity (against phenophthalein), filtered, boiled and 2nd carbonatation carried out to 0·02% CaO alkalinity before further filtration. The purity of the 2nd carbonatation juice obtained thus (juice 1) was 0·5 units higher than the normal juice (juice 2), the colour 4–5 St. lower, and the lime salts content lower. However, as no decomposition reactions occurred in liming, the colour rose considerably during 3 hours' boiling and evaporation (by 0·5–1·0 and 3 St. respectively). The filtrability of 1st carbonatation juice purified by instantaneous liming was almost the same as with normal juice, slight differences in the filtration velocity occurring only with differences in the amount of lime added during liming. The settling rate of juice 1 was double that of juice 2. The filtration velocity of juice subjected to progressive pre-defecation and instantaneous liming (juice 3) was lower than that of juices 1 and 2, and was even lower with slow (dropwise) additions of lime. However, with normal progressive pre-liming and instantaneous liming the filtration velocity is still sufficiently high for juice treatment in hydrocyclones. The settling rate of juice 3 was lower than that of juice 1, although double that of juice 2. The fine sediment is more crystalline and thus results in a brighter clarified juice while causing no snags in the hydrocyclones. The colloid content of juice 3 is also lower.

Increasing the yield of crystal sucrose by substituting original non-sugars with appropriate salts. I. Laboratory tests. II. Pilot plant tests. U. TOMIČ. *Listy Cukr.*, 1961, **77**, 25–30, 31–35.

I. Various methods of ion-exchange treatment of sugar factory products and their defects are briefly surveyed. A new method is described in which "Lewatit S-100" cation and "Amberlite IRA-400" anion resins are regenerated with certain salt solutions for treatment of thin juice and molasses. The cations were subsequently exchanged for Ca^{++} and Na^{++}, the former by use of a NH_4^+-cycle cation exchange resin, the effluent of which was treated with CaO to expel the ammonia, excess CaO being precipitated with CO_2. The sucrose in molasses was reduced by 46·5%, 35·2% and 26·5% in the Ca nitrate-, calcium- and sodium nitrate-molasses respectively.

II. Ten litres each of "S" cation exchange resin (1·8 meq/ml capacity) and "S 8-TM" anion exchange resin (1·4–1·5 meq/ml capacity) were used as above to treat 100–150 litres of thin juice at 80–90°C. Results were: sugar reduced by 71·7%, 45·6%, 37·2% and 65% in Ca nitrate-, Ca-, sodium nitrate-, and Ca chloride-molasses respectively. The decolorizing capacity of the anion exchanger on the Cl^- cycle was determined, using a thin juice of 12·5 St. After filtration of 50 volumes of juice on one volume of resin, decolorizing efficiency was still of the order of 90%.

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Stabilizing of colloids during beet purification. V. TIBENSKÝ. *Listy Cukr.*, 1961, **77**, 36–39.—The exchange capacity of colloids in beet juice, i.e. the rate at which these bind calcium, was determined by adding Ca chloride to raw juice and determining the effect on pH. Part of the colloids behaves similarly to a cation exchange resin in H^+ form, exchanging Ca^{2+} for H^+ and liberating 1–3 meq of acid salts per litre of juice. The amount of lime bound during the reaction was 15 meq/litre. Dry coagulate containing about 42% albumin, 26% polygalacturonic acid and 8% ash was added to sucrose-lime solution and the alkalinity and CaO content determined after 24 hr. It was found that 1·0 g of dry coagulated colloid will bind 3·0–3·5 meq of Ca^{2+}, indicating that the capacity depends on the reaction agent. In the raw juice about 0·3 g of CaO is bound per 100 ml of juice (1·0 meq Ca^{2+}). With addition of 0·35% CaO to pre-liming, about 0·2 g of CaO is bound per 100 ml juice. Colloids isolated with alcohol or acetone have less binding capacity. Juice pre-limed at 20, 50 and 80°C for 30, 20 and 10 min respectively, was treated with milk-of-lime or a sucrose-lime solution (0·3–0·4% CaO). The anions were converted to hydroxide by treating with "Zerolite FF" anion exchanger on the OH^- cycle. The alkalinity and CaO content were then determined and the theoretical natural alkalinity calculated. The alkalinity of the normal "stabilized" juice limed progressively was roughly the same as that of juice to which excess lime had been added

[1] *See I.S.J.*, 1961, 63, 184.

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in one dose, although the physico-chemical properties of the precipitate differed. The effect of temperature on the coagulation of colloids was studied at up to 0·1% CaO alkalinity. At 0·05% CaO coagulation increased substantially with temperature. Coagulation was very slight at the two lowest alkalinities at below 30°C. The significance of progressive counter-current pre-liming lies in the prevention of local over-liming of juice before optimum coagulation is attained.

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Decolorizing ion exchangers. XIII. Desorption of colouring bodies. E. ANIŠČENKOVÁ and V. VALTER. *Listy Cukr.*, 1961, **77**, 39–44.—Molasses of 30°St. colour was treated by "Wofatit E" (now "Wofatit EW") amphoteric ion exchange resin, which had been regenerated with 1% NaOH solution and 1·5% NH_4Cl solution at pH 7. Tests showed that the optimum concentration of NaOH from the point of view of decolorizing capacity is not 1% (0·25N) but 0·2% (0·05N), i.e. 0·05 gram-equiv./litre. The amount of colouring bodies not desorbed per unit weight of NaOH rises with fall in the NaOH concentration over the whole range of normalities from 0·001N to 1·00N. With drop in the concentration from 1% to 0·2% the NaOH consumption is reduced by about 75% while water consumption and desorption capacity (at constant specific loading) rises by about one-third. The increase in water requirements may be avoided by re-utilizing the first part of the eluate which will contain very little colouring substance, although the desorption period will not be reduced in this way.

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Nomograms for the determination of operating data for shaft lime kilns. H. BOCK. *Zucker*, 1961, **14**, 121–128.—Nomograms are presented for determination of the weight of coke per skip and the requirements in air for combustion. Modifications are given allowing for variations in operating conditions and for constant limestone weight per loading cycle.

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Supervision of boiler feed water in sugar factories. K. GARTEMANN. *Zuckererzeugung*, 1961, **5**, 43–47.—The elimination of harmful impurities from boiler feed water is discussed and the effect of increase in the concentration of organic acids in the boiler is described. The case history of one factory in which there was marked penetration of sugar into the feed water of a water tube boiler is quoted and analytical details are presented. Measures to be adopted in the determination of organic acids (alkalinity determination and humic acid calculation) are described.

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Mathematical analysis of diffusion. T. LJUDEVIT. *Zucker*, 1961, **14**, 149–154.—Differential equations are developed and two formulae derived for calculation of the concentration of sugar in exhausted cossettes (c_1) applicable to counter-current diffusion in one and two directions respectively, i.e. axial diffusion and axial plus radial extraction. The formulae are: $c_1 = \frac{8}{\pi^2} \cdot \frac{n-1}{n.e^{\lambda^2 DT} - 1}$ and $c_1 = \frac{64}{\pi^4} \cdot \frac{n-1}{n.e^{2\lambda^2 DT} - 1}$ where n = juice draught, D = diffusion constant, T = diffusion time and λ^2 is a parameter given by $\frac{n-1}{n} \cdot \frac{12}{l^2}$, where l = cossette thickness. The formulae differ from those of OPLATKA and SILIN by fixed constants, while the exponential function agrees with that of OPLATKA. Some calculated values of the pol of exhausted cossettes are tabulated.

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Beet preparation and its importance for sugar factories. K. BAGERT. *Zeitsch. Zuckerind.*, 1961, **86**, 138–140.—Equipment for handling of beets from the flume to the washer is discussed generally and a unit manufactured by Elfa-Apparate-Vertriebs G.m.b.H. described together with a new beet wheel.

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The present state of water treatment. ANON. *Zeitsch. Zuckerind.*, 1961, **86**, 142–144.—Methods used to treat boiler feed water are described, falling under the main headings of precipitation methods, ion-exchange processes, and de-gassing. The minimum amounts of each impurity to aim at in treated water are tabulated.

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Construction of the Fariman sugar factory (Iran). Z. KUNCEWICZ. *Gaz. Cukr.*, 1961, **63**, 44–48.—The Fariman factory, designed by Polish engineers, is described. With a daily slice of 1000 tons of beet, it includes a DdS diffuser, Szarejko filters, a quadruple effect Robert evaporator of 2000 sq. m. h.s., and six vacuum pans for a 3-massecuite system. In a trial run a 1st massecuite of 74·9 purity and a 3rd massecuite of 63·6 purity were obtained, with a final molasses purity of 55·2. Diffusion losses were 3·60%, undetermined losses 1·86% and in molasses 4·80%. Beet pol was 17–20%.

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Two new sugar factories in Rumania. W. STRUBE. *Zuckererzeugung*, 1961, **5**, 76–78.—Details are given of the Ludus white sugar factory of 2000 tons daily slice, designed by Fives Lille-Cail. Equipment includes an RT diffuser of 5 m dia., Graver clarifiers, Sweetland filters (the Wiklund purification system is used), and Werkspoor crystallizers. A 3-boiling scheme is used.

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Decolorizing ion exchangers. XIV. Production of refined sugar from decolorized syrup. K. ČIŽ, Z. MENCL and V. VALTER. *Listy Cukr.*, 1961, **77**, 55–58. Syrup decolorized by ion-exchange to 0·2–0·5°St was easily boiled, with more rapid nucleation and crystal growth, to a high purity sugar. However, during boiling of the loaf sugar massecuite (92°Bx) colour formation took place, the final colour being 150%

higher than the original. After 12 hr at 90°C in a digestion flask, the colour of the ion-exchange treated syrup was greater than that of syrup decolorized with bone char or active carbon.

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Power engineering problems of today and tomorrow. O. BÖHM. *Listy Cukr.*, 1961, **77**, 58–66.—Problems connected with heat and power generation and heat economy in sugar factories are discussed. They include optimum steam pressure in boilers, flue gas temperature, optimum pressure of exhaust steam, evaporators, vapour compression, supply of electricity to the national grid. Heat schemes are described including one which incorporates a gas turbine, steam boiler and steam turbine. Power station modernization and new methods of power production are also discussed.

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Juice purification. S. ZAGRODZKI. *Gaz. Cukr.*, 1961, **63**, 75–80.—Changes in pH during various purification schemes are illustrated by graphs and a new purification scheme is suggested. Juice is pre-limed progressively to pH 11, then subjected to 3-stage instantaneous defecation, whereby the milk-of-lime is added in 3 equal portions (making a total of 1·5–2·5% CaO) prior to feeding it to each of the 3 carbonatation vessels. The final pH of the 1st carbonatation juice is 11. The juice is twice filtered and subjected to 2nd carbonatation, the muds from which are treated in multi-hydrocyclones. The juice from the first of the 1st carbonatation vessels is returned to pre-liming. Advantages of the scheme are enumerated.

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Growth of sugar crystals in vacuum pans. J. MORZE. *Gaz. Cukr.*, 1961, **63**, 80–81.—The growth of sugar crystals is discussed mathematically. It is shown that the main cause of irregular crystals from a Robert pan is bad circulation during boiling. The poor design of the pan is blamed rather than faulty boiling.

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The heat economy of Buchachsk sugar factory. I. B. BAL'TSER and Z. E. ZINGEL'. *Sakhar. Prom.*, 1961, (3), 43–46.—The triple-effect evaporator had a total evaporation capacity of only 81·7% water on weight of beet instead of a required 102–103%, corresponding to a throughput of 1100–1200 tons of beet per day instead of 1500 tons. Pan performance suffered because of low 2nd effect vapour withdrawal to 1st pan heating. Changes were introduced including the installation of an extra heater before the evaporators and other modifications to the evaporation and boiling schemes, so that now 104·1% water on beet may be evaporated.

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Preliminary study on the technical value of beet according to analyses of sugar beets from 1959 field trials. I–III. J. HENRY, R. VANDEWIJER, R. PIECK and G. RENS. *Sucr. Belge*, 1961, **80**, 173–193; 218–234; 265–288. IV. J. HENRY and A. VANDEZANDE. *ibid.*, 313–330.—A thorough examination is made of the effect on the constituents of press juice, carbonatation juice and beet raspings of variety, nitrogen fertilization, date of harvest and field. The analytical results are presented in graph form and are interpreted statistically.

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Results of an examination of the technological value of sugar beet. M. DRACHOVSKÁ. *Zucker*, 1961, **14**, 182–187.—Experiments conducted on sugar beet are discussed. Formulae are presented for calculation of the white sugar yield and the sugar losses in stored beet. These take the form W = pol—1·2—4 kA, where W = white sugar % and kA = conductimetric ash; and $V_{stor} = AD\ (V_{stor\ 0} + T + 0{\cdot}1\,T^2)$ mg % where V_{stor} = storage losses, A = a coefficient based on state of beet and storage conditions and which has a value of 0·5 for healthy beet and excellent conditions and a value of 4 for very poor beet and unfavourable conditions, D = number of days, $V_{stor\ 0}$ = losses at 0°C and T = temperature. The MW factor is given by $MW = 8{\cdot}2\ h/(\text{pol}—1{\cdot}2—0{\cdot}0416\ h)$, where MW = molasses per 100 kg white sugar and h = a coefficient of electrical conductivity measured by the Šandera "Conductometer." The chemical and biological properties of the beet are not the only criteria in evaluation of the "optimum" beet, but numerous other factors must be considered.

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The efficiency of hydrocyclones in the separation of 2nd carbonatation muds. O. ASP. *Zucker*, 1961, **14**, 192–194.—See *I.S.J.*, **63**, 183.

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Automatic conveyor units in sugar factories. ANON. *Zucker*, 1961, **14**, 194–199.—A description is given with illustrations of a beet conveying unit manufactured by AMAWERK G.m.b.H.; three such units have been supplied to Soviet factories for conveying beet to the tare house.

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Raw juice extraction by the Steckel process. P. MÜLLER. *Zeitsch. Zuckerind.*, 1961, **86**, 207–209.—Details are given of a pilot plant and of tests at Schleswig factory on the Steckel patented process for extraction of juice from beet brei. The beet are reduced to mash by rasps and the mash then heated by steam while passing on a conveyor to the centrifugals where the juice is extracted. The extracted pulp, still containing about 50% of its original sugar, travels along a 3-circuit conveying system in which it is treated with water and juice. The pulp is then filtered. The total extraction time (4-stage cycle) for a 1200 tons beet/day plant would be 3–4 min. Advantages of the system are: extraction at higher temperatures than with normal diffusion, higher sugar extraction with lower molasses yield, less water to be evaporated from the pulp, and much more rapid extraction.

NEW BOOKS AND BULLETINS

La Industria Azucarera Venezolana—Hechos y Estadisticas. (The Venezuelan Sugar Industry—Facts and Figures.) 22 pp; 7 × 8¾ in. (Distribuidora Venezolana de Azúcares, S.R.L., Caracas, Venezuela.) 1961.

This little booklet, issued to mark the 5th anniversary of D.V.A. is attractive and well-printed. It provides an account of this non-profit organization which was set up by the sugar-producing companies to sell and distribute their products. A series of coloured diagrams illustrate the extent of participation by each central, the DVA organization, the location, age, and production of each factory, progress of investment since 1953, cultivated area and field investment, labour employed, sugar and papelón production, sales, credits, production capacity, forecast for 1970 compared with 1961, sugar and other prices compared with 1938, and the cost of sugar as a proportion of food purchases, viz. 2%.

* * *

Historia en serio y en broma de la Distribuidora Venezolana de Azúcares, S.R.L. 1956-1961. (Serious and humorous history of the Distribuidora Venezolana de Azucares, S.R.L. 1956-1961.) 20 pp; 7 × 8¾ in. (Distribuidora Venezolana de Azúcares, S.R.L., Caracas, Venezuela.) 1961.

This companion booklet to the above describes and illustrates by means of cartoons the difficulties and principal events in the setting up of the DVA and since its formation.

* * *

Cuba Sugar Year Book. (Ministry of Foreign Trade, P.O. Box 2549, Havana, Cuba.) 1961. Price: $5.00.

The latest edition of the Year Book contains the new structure of the sugar industry with changed names to date. The "Sugar Census" provides information on the individual mills—year of establishment, cane ground, % yield, etc. Production figures for sugar, molasses, alcohol, etc. are included as well as cane areas, sugar prices, and maps showing ports, distances, railways, roads, etc. Besides cane and cane products data, there is an account of taxes and legislative measures affecting the industry. A foreign section refers to sugar production in the U.S. and associated territories, world sugar crops, etc.

* * *

Food Processing & Packaging Directory 1961-1962. Ed. R. DE GIACOMI. 917 pp; 5¼ × 8¼ in. (Tothill Press Ltd., 33 Tothill Street, Westminster, London S.W.1.) Price: 60s 0d.

This is the 5th edition of the reference work that was previously entitled "Food Directory." The structure of this edition is unchanged with its main sections of Food Manufacturers, Commodities, Plant & Equipment, Packaging Materials, Brand Names, and Food Laws. Other sections give information on Government departments, food research organizations, trade associations, schools and colleges with full-time specialized courses in food technology, and a list of consultants. A new feature is a list of food processors holding a Royal Warrant of Appointment, which is also indicated in the entries of the individual companies. The four main sections are divided into two parts, one giving names, addresses and telephone numbers, the other a classified list of materials or products. The changes of pattern within the industry resulting from re-grouping and merging of food manufacturers are noted. The section on food standards and regulations throughout the world, prepared by C. L. HINTON, F.R.I.C., includes new sub-sections on Iran, Jamaica, Nigeria, Sarawak, Tunisia, and the Soviet Union. The U.S.A. entry includes a comprehensive tabulation of food additives, many of which will be subjected to legislative review.

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Proceedings of the Sixth Technical Session on Bone Char, 1959. Ed. V. R. DEITZ. viii + 378 pp; 8 × 10½ in. (Bone Char Project, Inc., c/o Revere Sugar Refinery, 333 Medford Street, Charlestown 29, Mass, U.S.A.) 1961.

This volume is a record of the Sixth Session held in Montreal, Canada, in 1959 and is in the same format and style as previous Proceedings. The major part includes the texts of the 15 papers presented together with the discussions that followed each paper. The book opens with a list of delegates (95) attending the Session, a list of industrial sponsors and members of the 1958–1959 Board of Directors. Introductory remarks made by E. J. GRANT of St. Lawrence Sugar Refineries Ltd. immediately precede the papers. The volume closes with a list of abbreviations as well as a name and a subject index, as in previous editions. A keyed group photograph of the delegates is included.

* * *

F. O. Licht's Internationales Zuckerwirtschaftliches Jahr- und Adressbuch 1960/61. (International Sugar Economic Year Book and Directory 1960/61.) H. AHLFELD. 412 pp + 60 pp; 8½ × 11½ in. (F. O. Licht K.-G., P.O. Box 90, Ratzeburg/Lbg., Germany.) 1961. Price: DM34; 60s 0d.

Apart from the inclusion of more up-to-date information, the latest edition of this reference work is basically similar to the previous edition[1]. Three countries have been added to those represented under the heading of sugar organizations, viz. Korea, Colombia, and Venezuela. The only other noticeable change is in the atlas, which is of the Union of India. The book is well printed and is recommended as a most valuable guide to the world sugar factories, refineries and organizations, etc.

[1] *See I.S.J.*, 1960, **62**, 227.

LABORATORY METHODS AND CHEMICAL REPORTS

Non-sucrose constituents in raw sugar crystal. III. Colour formation from reducing sugars. C. C. Tu, R. H. Okamoto and K. Onna. *Hawaiian Planters' Record*, 1961, **56**, 169–181.—Melanoidin was formed by dissolving 2 g glucose and 5 g alanine in 30 ml water and boiling under reflux for 15 hr. After 20 min a dark brown solution was formed and precipitation occurred after heating for several hr. Electrophoresis using an alkaline buffer indicated the presence of two coloured bands which migrated in opposite directions, that migrating towards the cathode being similar to that in raw sugar crystal. Paper chromatography showed that both precipitate and melanoidin solution consists of several acids and unreacted glucose and glycine. Sucrose (13 g) was dissolved in 30 ml water and the solution inverted with 5 ml conc. HCl at 70°C for 5 min. The pH was adjusted to 11 and the solution refluxed for 10 hr. Precipitation occurred after several hours' heating, after which the pH was 4·6. Electrophoresis produced a brown band which migrated towards the cathode and was similar to that in raw sugar crystal. Chromatography using *n*-butanol:pyridine:water (6:4:3) as indicated that fructose was almost completely decomposed while a considerable amount of glucose was unchanged. Using a solvent of phenol-water (80:20), both solution and precipitate were found to contain a group of acids similar to those in raw sugar crystal. The precipitate was alkali-soluble. The colour of the solution darkened with increase in pH. Two 18% glucose solutions of pH 6·5 and 9·0 were heated at 80°C for 4½ hr. The solution of pH 9·0 developed a very little colour, the other none at all. Transmittancy curves are given for glucose solutions of different pH values. Two 3·3% glycine solutions at pH 6·5 and 9·0 were also heated for 4½ hr at 80°C, neither solution developing any colour. Transmittancy curves are given for glycine solutions at different pH values, and for melanoidin solutions prepared from glucose and glycine. From these tests it is possible to differentiate between the colour due to thermal degradation products from reducing sugars and that due to melanoidin.

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An investigation of the polysaccharides present in sugar mill syrups. G. K. Sutherland. *Austral. J. Biol. Sci.*, 1960, **13**, 300–306.—Details are given of the procedure used to separate the polysaccharide fractions obtained from syrups from various Australian and Fijian cane factories. Electrophoresis revealed two main polysaccharide constituents: the dextran referred to earlier[1] and a hemicellulose present in all syrups. The electrophoretic mobility of the dextran differed from that of dextran found in stale cane or formed by *Leuconostoc mesenteroides*.

On an objective determination of the colour of sugar products. A. K. Kartashov and N. N. Kostenyuk. *Sakhar. Prom.*, 1961, (3), 18–20.—The light filters in the Soviet FEK-M photocolorimeter were replaced by interferential light filters of 420 and 720 mμ wavelength and the instrument tested according to the ICUMSA method[2]. The instrument was also used to determine the light absorption as normally applied, viz. measuring the optical density of a decolorized white sugar solution of 50° ± 0·2° refractometric Brix at 420 and 720 mμ. The results were compared with those obtained by a Stammer colorimeter, and these tabulated and expressed in graph form. The maximum deviation from the mean was 13% and 6% for sugars of approximately 1 and 2°St colour in the case of the Stammer instrument, and only about 1% for the FEK-M, which will measure solutions of 0·1–0·4°St unlike the the Stammer instrument. The modified FEK-M is recommended therefore. A wavelength of 560 mμ is to be used for darkly coloured products.

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Determination of the purity of beet juice. A. A. Gerasimenko, M. A. Abramova and L. S. Petrenko. *Sakhar. Prom.*, 1961, (3), 31–32.—Analysis of juice obtained by mixing pulp obtained with a Golovin rasp in water and filtering gives values of sugar content and purity closer to raw juice analyses than does analysis of normal press juice from beet slices obtained with a chopping machine, since the press juice analysis depends on the thinness of the slice and the first portions give a lower purity than subsequent portions because of a lower initial pressure applied.

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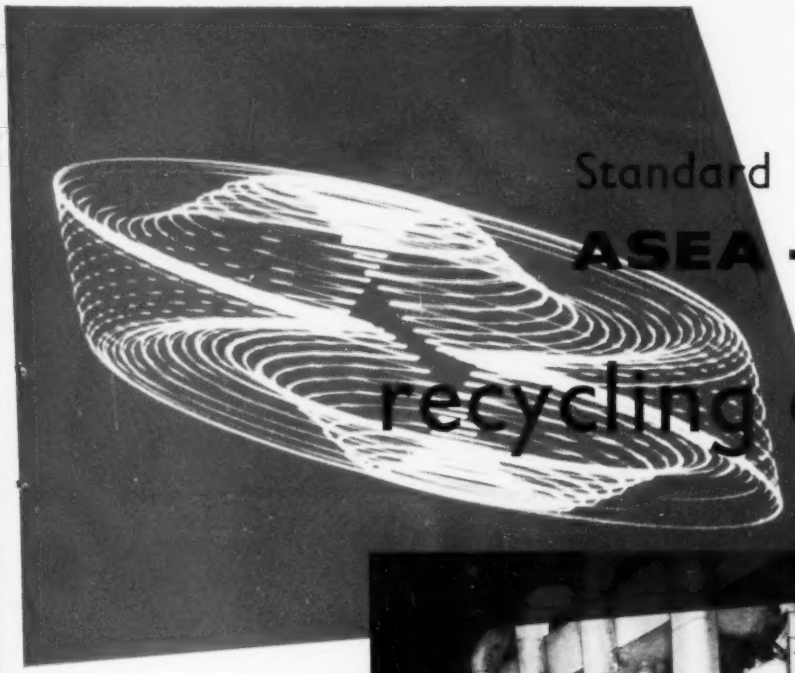

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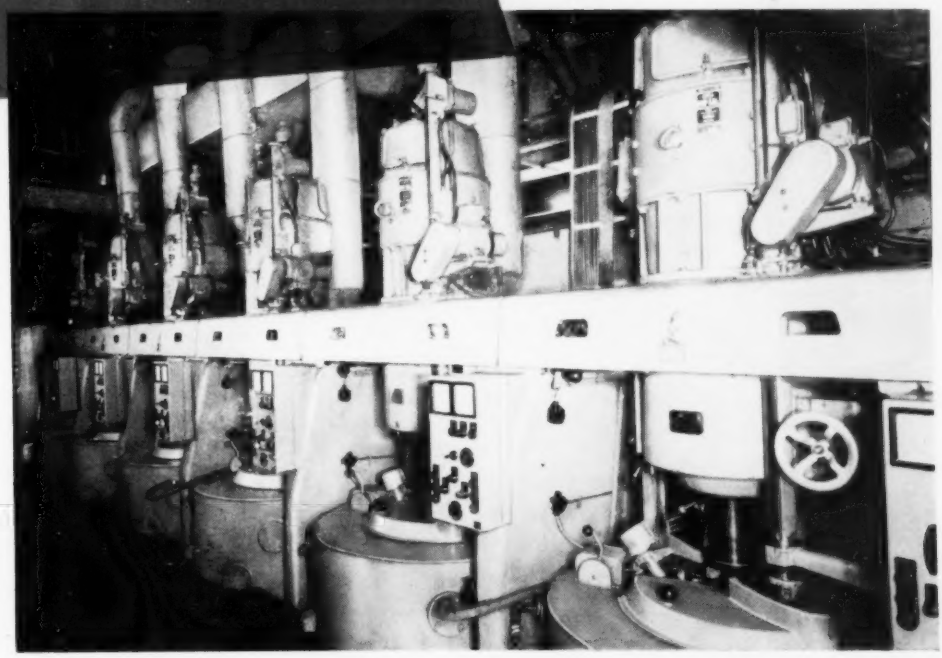

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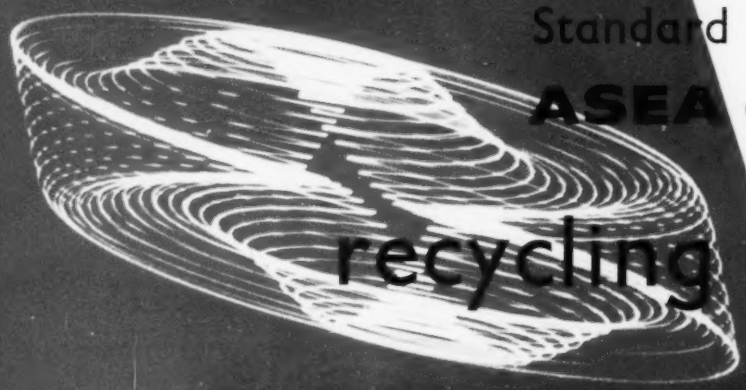

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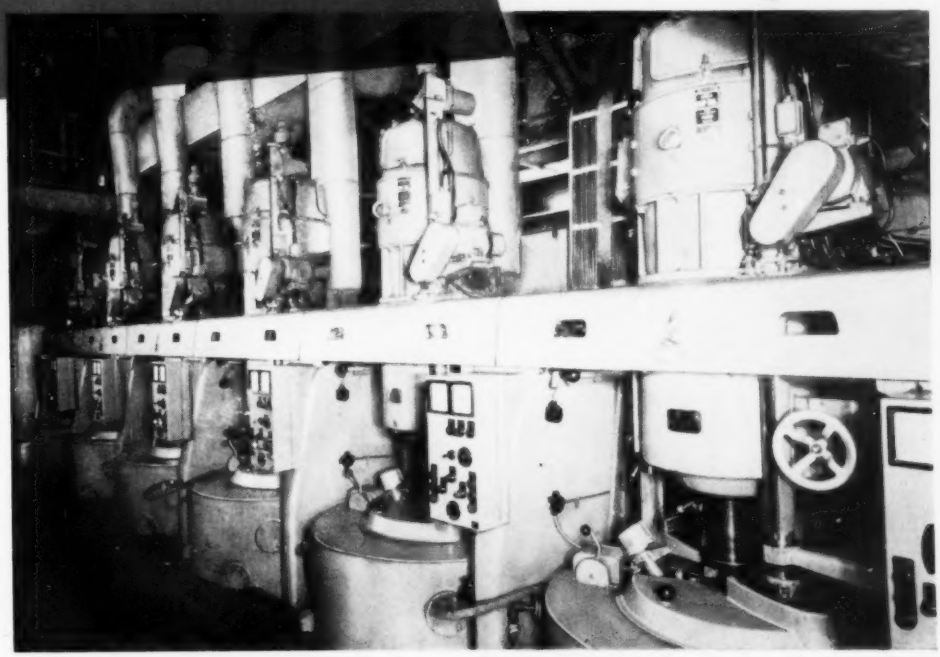

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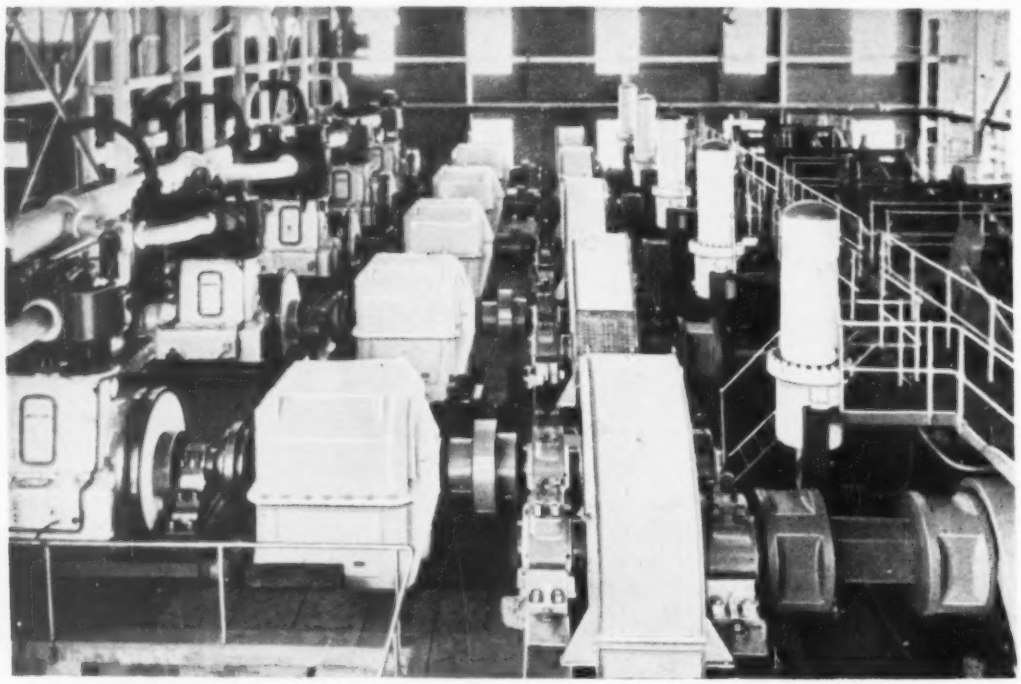

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Modern glass electrode measuring cells—possibilities and limits. H. K. FRICKE. *Zucker*, 1961, **14**, 162–168; 188–191.—The relationship between pH sensitivity and the hydrolytic durability of different types of glass reveals an upper limit to the temperature resistance of glass electrodes at about 130°C in continuous use. The effect of temperature on different reference electrodes and the properties of buffer solutions with which the cells are filled are discussed, particularly the effect of buffer solutions on the accuracy of the temperature compensation. The possibilities of measuring pH at high pressures and in aggressive media are demonstrated, and it is shown how to protect the electrode from penetration of "electrode poisons." Some special cells are described which are of interest in view of the restrictions imposed on glass electrodes by techniques of glass blowing.

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Adsorption of certain non-sugars on calcium carbonate. J. DEDEK. *Paper presented to the 14th Tech Conf., British Sugar Corp. Ltd.*, 1961.—Calcium carbonate was precipitated by interaction of Na_2CO_3 and $CaCl_2$ in the presence of sucrose to which had been added varying amounts of a number of amino acids, colouring substances, dextran and beet molasses. The results are presented in graphs of log (adsorbed material) *vs.* log (material remaining in solution) and are discussed.

* * *

Nucleation and growth of sucrose crystals. H. E. C. POWERS. *Paper presented to the 14th Tech. Conf., British Sugar Corp. Ltd.*, 1961.—Mechanisms of spontaneous and vegetative nucleation of pure sucrose solutions are discussed, with reference to the phenomenon of nucleation in the trail of a crystal moving through the solution. Investigation is now being made to determine the critical speed under various conditions. Mention is also made of recent developments in the study of sucrose crystal growth.

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Juice components in relation to sugar quality. A. CARRUTHERS, J. F. T. OLDFIELD, J. V. DUTTON, L. C. MANNING and M. SHORE. *Paper presented to the 14th Tech. Conf., British Sugar Corp. Ltd.*, 1961.—Analyses were made of sulphated ash, K, Na, raffinose, betaine, pyrrolidone carboxylic acid and a number of amino acids, in white sugar and the standard liquors from which they were boiled. The respective ratios are designated "elimination factors" which are generally of the same order, but in certain cases indicate a preferential absorption by the sugar crystal, e.g. raffinose and floc; such materials are often those causing problems in the production of high quality sugar. Crude floc from a 20° Bx standard liquor dilution, acidified to pH 1·5 and heated to 85°C, was separated and fractionated into methanol- and 0·2N NH_4OH-soluble material; similar treatment of a white sugar solution established that the ammonia soluble portion was more strongly absorbed. The methanol-soluble fraction was separated into heptane-, benzene- and chloroform-soluble material, the proportions varying considerably from juice to juice and sugar to sugar. Examination of saponin elimination showed that it was also selectively absorbed by the sugar crystallizing. By use of a "Sephadex" column [of porous insoluble dextran gel particles which allow permeation of small molecules but not large molecules so that the latter move along a short path outside the particles while the former have a longer path through the whole of the column], nitrogenous macromolecules—proteins and polypeptides—were separated from sugar solutions. These were shown to be strongly absorbed by the sugars, as were laevan and araban isolated from the "Sephadex" eluate. The N compounds have the major effect on the polarographic oxygen maxima, it is suggested, while saponin is the primary source of visible floc. This may be removed from thin juice by treatment with porous quaternary ammonium anion exchangers on the chloride cycle; the cost, assuming a resin life of 235 cycles, is estimated at 5s 0d per ton of sugar. Floc can be removed from a 66° Bx syrup with 0·15% on sugar of active carbon; this is suggested as suitable for production of high-grade liquid sugar. In a study of potassium imidodisulphonate in white sugar it was observed that active growth of the bacteria responsible for nitrate formation could occur at 81°C and measures to reduce nitrite production after clarification and in raw juice production and storage are suggested, including continuous addition of 50 p.p.m. of chlorine to juice in storage tanks, returns from depulpers and spillage, shock dosing with formaldehyde and minimization of stagnant juice lines, e.g. to stand-by pumps. Routine determination of nitrite would provide warning of when action was necessary.

* * *

Degradation of sucrose, glucose and fructose molecules in an ultrasonic field. D. BUCHNEA. *Zeitsch. Zuckerind*, 1961, **86**, 197–203.—The nature, effect and production of ultrasonic waves are described and details are given of experiments in which sucrose, glucose and fructose solutions were subjected to ultrasonic waves at 300 kc/s–1800 kc/s under varying conditions. With increase in the frequency the temperature of the solution also increased, accelerating the decomposition of the sucrose while decomposition of the monosaccharides was more a result of oxidation. Results of tests in which the sucrose was supplied with air, CO_2-free air, oxygen, nitrogen and hydrogen during the ultrasonic treatment showed that in the presence of oxygen, the sucrose was decomposed more quickly with formation of CO_2 and formic acid. On the other hand, in the presence of hydrogen, the sucrose was inverted very slowly without any acid formation. In alkaline medium, the ultrasonic waves had only a very slight inversion effect. With increasing concentration, the rate of inversion caused by the waves increased to a maximum, although if the solution were cooled during treatment, no inversion occurred.

BY-PRODUCTS

Separation of potassium salts from molasses. R. KRAJEWSKI. *Gaz. Cukr.*, 1961, **63,** 82.—To improve fermentation and increase the yield of ethanol and butanol from molasses, the potassium salts are isolated by adding calcium sulphate (gypsum) and sulphuric acid to form the double salt $CaSO_4.K_2SO_4.H_2O$. At 12–14°C this is only sparingly soluble and can be precipitated. Thus 79–85% of the K_2O in the molasses is removed.

* * *

Manufacture of dehydrated cane juice. A. ARELLANO CASSONI. *Bol. Azucar. Mexicano*, 1960, (Sept.), 40–41; through *S.I.A.*, 1961, **23,** Abs. 5.—A flowsheet is given of a process for the manufacture of a crude product out of season. Raw cane juice is limed, heated, evaporated, boiled to 85°Brix and stirred in a crystallizer and dried and granulated. The process can be applied before and after the usual campaign. The product, a dark green, coarse powder, has 85–87° pol, contains minerals and vitamins, and is suitable as a fodder constituent.

* * *

Synthesis of polyoxyethylene derivatives of diesters of sucrose with long-chain fatty acids. S. KOMORI, M. OKAHARA and K. OKAMOTO. *J. Amer. Oil Chem. Soc.*, 1960, **37,** 468–473; through *S.I.A.*, 1961, **23,** Abs. 31.—Sucrose dimyristate, dipalmitate, distearate, dioleate and dierucate, prepared by interesterification of sucrose and the corresponding methyl esters, in glyoxal at 30 mm and 100°C, were made to react with ethylene oxide in an autoclave, in the presence of an alkaline catalyst, to form polyoxyethylene derivatives of sucrose diesters. The number of oxyethylene groups per molecule was calculated from the measured saponification values. The products generally were yellow or orange waxes or oils, melting points 10–40°C, soluble in water and practically non-toxic. They reduced the surface tension in aqueous solution and the interfacial tension against kerosene to about the same level as with a polyoxyethylene derivative of sorbitan mono-oleate ("Tween"). Foaming properties are shown. Values of physical properties of the methyl esters, sucrose diesters and the oxyethylene derivatives and figures concerning the synthesis reactions are given in tables. It is concluded that these compounds are suitable as emulsifying agents in the food industry.

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Acetic acid by submerged fermentation. ANON. *Chem. Eng.*, 1960, **67,** (18), 50–52; through *S.I.A.*, 1961, **23,** Abs. 32.—The new process for production of glacial acetic acid at Chiayi Solvent Works, Taiwan, is described with a flow diagram. A mash containing 1–2% of molasses, 1–2% of ethyl alcohol and nutrients is inoculated with a special strain of *Acetobacter* having a fermentation efficiency of 95%, and is stirred and aerated by a hollow 120–150 r.p.m. agitator. The alcohol content is maintained continuously. When the acid content reaches 10% (after 48–60 hr) the mash is removed and extracted with ethyl acetate in a continuous counter-current extractor. Solvent and water are distilled azeotropically from the extract in a concentration column, and the concentrate is redistilled to obtain glacial acetic acid. Production costs are comparable to those of the synthetic process.

* * *

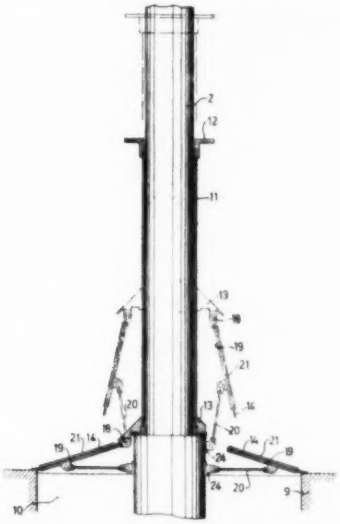
Microbiological production of citric acid from Egyptian cane molasses. I. Treatment of Egyptian molasses with alcohols. E. E. M. TAHA and T. A. ELZAINY. *Egypt. J. Chem.*, 1959, **2,** 157–162; through *S.I.A.*, 1961, **23,** Abs. 33.—The effect of the addition of 2·5% of different alcohols or ethyl acetate on the microbiological formation of citric acid from molasses was examined. Cane molasses, diluted to ~15% sugar concentration, was incubated at 30°C for seven days with a local *Aspergillus niger* strain. Citric acid yield and conversion percentage were calculated from the analytical figures, and compared with figures for blank tests obtained without addition of alcohol. Growth was completely inhibited by either *n*-butanol or *n*-propanol, whereas ethyl alcohol had a slight retarding effect. Ethyl acetate had no practical effect, but methanol proved to have a strong stimulating effect on both citric acid production and mycelial growth. Experiments with methanol added in different concentrations showed that with more than 2·5% of methanol the acid production decreased and came practically to a standstill at 5%. The conversion was also highest at 2·5–3% of methanol with a sucrose conversion of 68–69%.

* * *

Microbiological production of citric acid from Egyptian cane molasses. II. Factors determining the acid production from alcohol-treated molasses. E. E. M. TAHA and T. A. ELZAINY. *J. Chem. U. A. R.*, 1960, **3,** 109–116; through *S.I.A.*, 1961, **23,** Abs. 34.—Incubation of diluted cane molasses, to which 2·5% of methanol was added, was carried out 14 days after inoculation with *Aspergillus niger* 571. The yield of citric acid and the conversion efficiency were calculated on the sugar originally present, or on the quantity of sugar consumed. A maximum acid yield of 66·8% was obtained after 10 days, and the yield thereafter began to decrease. The quantity of citric acid, determined colorimetrically, was nearly equivalent to the titratable acidity in the temperature range of 25–35°C. A temperature of 30°C proved to be optimum for the acid yield, whereas the optimum for the conversion coefficient was at 25°C. At an initial pH 2·0 of the molasses, growth was completely inhibited; with increasing pH, production increased to a maximum at pH 6–7. The inversion coefficient increased in these circumstances up to pH 5. The citric acid production did not appear to be greatly affected by the dilution of the molasses.

UNITED KINGDOM

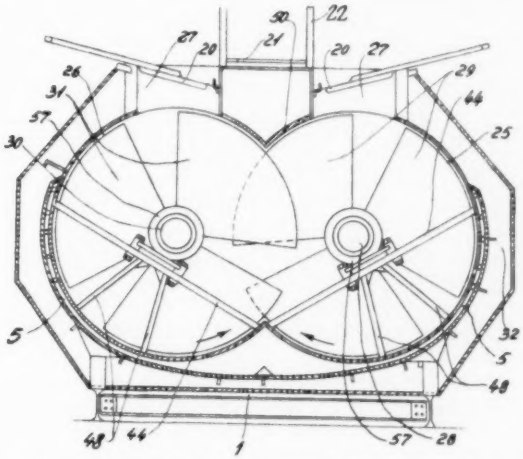
Centrifugals. AB. LANDSVERK, of Landskrona, Sweden. **864,596.** 2nd October 1959; 6th April 1961. The valve closing the discharge outlet 10 of the centrifugal comprises a flexible frustroconical (rubber) diaphragm 14, carried by a sleeve 11 rotating with spindle 2. This sleeve has a flange 12 at the top and a cone 13 at the bottom. The diaphragm is pivoted about the cone by joints 18 and is supported by struts 20 attached to the sliding ring 24. The diaphragm is also stiffened by supporting plates 21 on its upper side which are such as to provide unsup-



ported flexible portions between them. The sleeve 11 is located by a supporting roller under the flange 12; when it is required to discharge the centrifugal's contents, the roller is raised, so bringing the flange to the higher position indicated by broken lines. The cone 13 also rises, as does the ring 24. However, the ring 24 is prevented by an abutment from rising to the same extent as the sleeve, so that the diaphragm closes as indicated, the flexible sections double-folding and struts 20 pivoting about their respective journals.

* * *

Process and apparatus for the continuous lixiviation of divided solid material (Beet and cane diffuser). A/S. DE DANSKE SUKKERFABRIKKER, of Copenhagen, Denmark. **869,258.** 9th January 1957; 31st May 1961.—The diffuser comprises a steam jacketed tank 1 mounted at an inclination to the horizontal on a number of supports, with a feed inlet for cossettes in the top surface at the lower end and a driven bucket wheel arrangement at the other end for discharge of spent pulp. Hot water is introduced through inlets at the upper end of the tank and juice withdrawn through a screened discharge outlet at the lowest point of the tank. Access to the inside of the tank is through a series of doors 20 adjacent to a cat walk 21 fitted with handrails 22. Channels 27 serve as vent passages for evolved gases and as collection spaces for excess juice in the event of accidental flooding. Movement of the cossettes from the lower to the upper end is effected by a dual conveyor unit 25, 26 driven from the ends of the tank and in the form of shafts 28, 30 rotating in opposite directions and carrying perforated sections 29, 31 of opposite-handed helical flights. These interrupted helices are intermeshed and, to avoid heterogeneous compaction of cossettes (and thus non-uniform extraction), the



trailing edges of the flight sections are approximately in axial alignment with the leading edge of the subsequent section. The conveyors may have one or more threads, in each case the peripheral arc of each flight being less than 360° divided by the number of threads. Breaker bars 44 located in the spaces between adjoining flight sections ensure proper axial movement of the cossettes along the tank. These bars, supported by bars 48, carry shaft bearing housings 57 at certain positions along the tank; in other positions they may be joined by connecting

Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 3s. 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

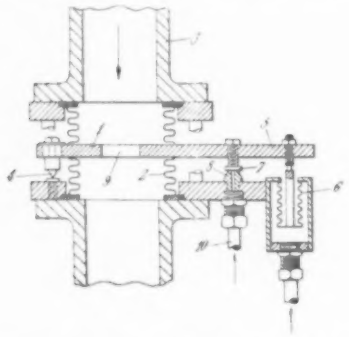
horizontal bars. The conveyors may alternatively be rotated in the same direction, in which case the helices must be similarly-handed, and operate to raise the cossettes from the lower to the higher end of the tank.

* * *

Fermentation process for the production of D-arabitol. DISTILLERS CO. LTD., of Edinburgh 3, Scotland. **870,622.** 16th September 1959; 14th June 1961.—A suitable nutrient medium, containing sucrose as a source of assimilable carbohydrate (supplied as molasses), urea and corn steep liquor, is fermented under aerobic conditions at 30–35°C using a D-arabitol-producing strain of *Hansenula* (*H. subpelliculosa*) and recovering the D-arabitol from the fermented medium.

* * *

Fluid flow regulating apparatus (Char cistern outlet control). TATE & LYLE LTD., of London, E.16. **871,149.** 21st May 1958; 21st June 1961.—An orifice plate 1 sealed on each side by flexible bellows 2 is inserted into a joint in pipe 3. At one side of the joint the plate pivots on adjustable knife-edge 4, while on the other side an extension 5 of plate 1 is anchored to a fluid pressure operated bellows 6 (the



hand or automatically-set regulator) and also carries the seating 7 of a spill valve 8. In use the fluid passing along pipe 3 transmits a load to seating 7, augmented or reduced by the thrust of bellows 6. This load determines the maximum pressure developed at valve 8 which in turn serves to set a control valve, not shown, by way of connexion 10; this valve controls the fluid flow rate through pipe 3 and will normally be inserted in the pipe 3 upstream of plate 1. The spill valve will normally be operated using air as the pressure fluid. The device will generally be used to maintain a constant flow.

* * *

Beet harvester. H. C. OPPEL, of Boise, Idaho, U.S.A. **871,638.** 3rd June 1959; 28th June 1961.

UNITED STATES

Production of L-glutamic acid. K. YAMADA, of Tokyo, Japan. (A) **2,978,383.** 25th January 1960; 4th April 1961. (B) **2,978,384.** 24th November 1959, 4th April 1961.

(A) *Brevibacterium divaricatum* NRRL B-2311 is cultivated in a aqueous medium containing an assimilable carbohydrate source (glucose, fructose, mannose, maltose or glycerol) and an assimilable nitrogen source (urea, ammonium salts, casate, peptone, corn steep liquor, meat, yeast or bran extracts, or mixtures of these) at 10–37°C (28–31°C; approx. 30°C) and pH 6–9 under submerged aerobic conditions (for about 72 hr) after which it is filtered, partly concentrated, and adjusted to pH 3·2 when the glutamic acid crystallizes.

(B) The strain used is NRRL B-2312.

* * *

Refining (washing) of sugar (in a centrifugal). W. HAWKSLEY, *assr.* TATE & LYLE LTD., of London, E.C.3. **2,984,591.** 12th January 1959; 16th May 1961.—In the usual spray washing of a sugar layer in a centrifugal at the rate or 3–5 gal over a period of 20–30 sec, it is doubtful whether the water impinges on the charge or is entrained. To achieve vigorous impingement over a shorter period with improved washing but using the same quantity of water, the latter is supplied in a series of solid and undispersed streams towards different levels of the charge, at a rate of 1–2·5 (1·5–2·5) gal/sec, discharging from a closed tank by means of compressed air.

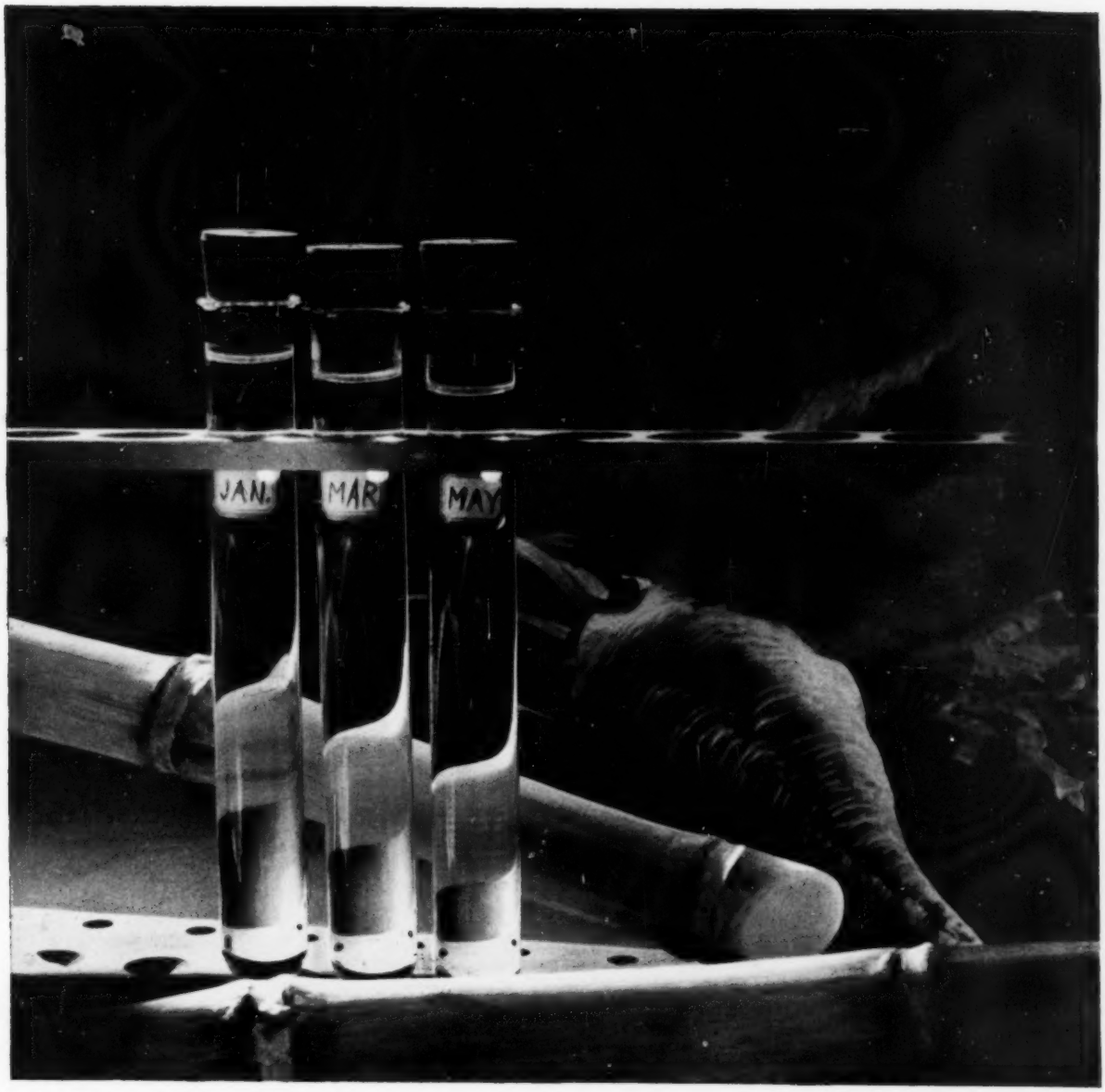
* * *

Purifying (beet) sugar solutions. S. VAJNA, of Köln, Germany. **2,988,463.** 20th March 1958; 13th June 1961.—Sugar solution, e.g. thin juice, is treated (at 70–90°C) by a cation exchanger whereby its alkali cations are exchanged for ammonium ions. It is then subjected (at 60–80°C) to ion exhange by a strongly basic anion exchanger, thereby removing anions and colouring matter and the ammonium hydroxide formed is blown off. The cation exchanger is regenerated with ammonium carbonate to give an alkali carbonate; this is causticized to alkali hydroxide which is used to regenerate the anion exchanger, the resultant solution being used as a starting material for forming the alkali metal carbonate by being passed through the cation exchanger (after passing the sugar solution through). The anion exchanger may be treated with sodium chloride solution either before or after regeneration, to remove colouring matter, and the NaCl solution sent to the cation exchanger as a further source of Na ions.

* * *

Mould for the production of slabs of sugar. M. WELSTEIN, assr. RAFFINERIE TIRLEMONTOISE S.A., of Tirlemont, Belgium. **2,991,202.** 2nd September 1958; 4th July 1961.—See U.K.P. 839,291.[1]

[1] *I.S.J.*, 1960, **62**, 264.



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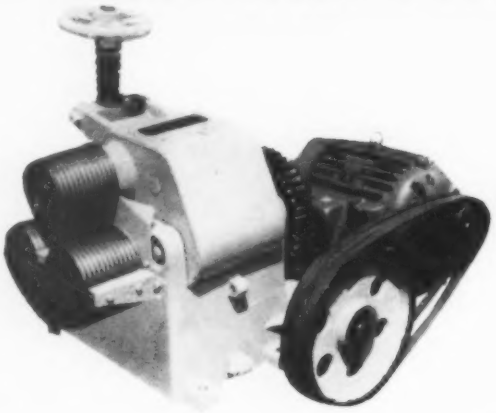
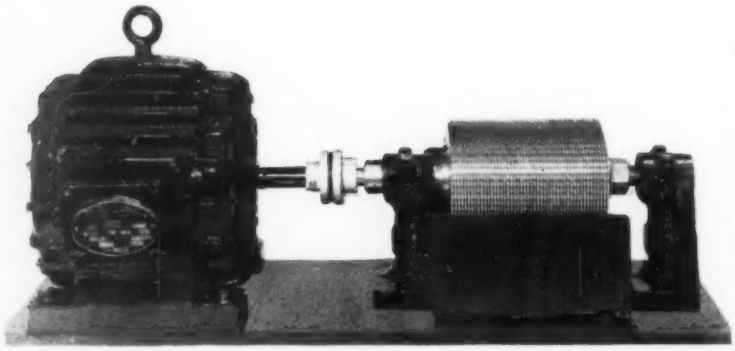
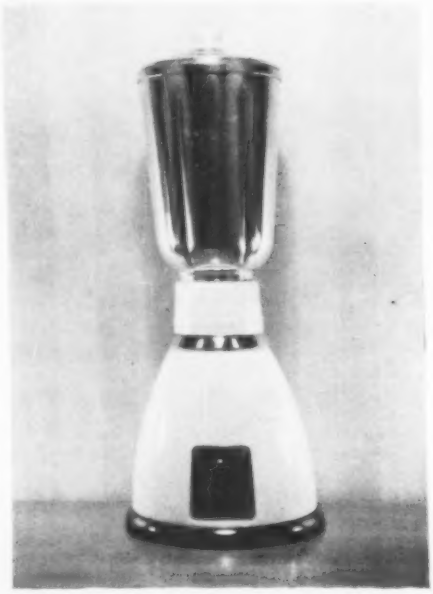
CANE AND BAGASSE ANALYSIS



Our **ROLEX** laboratory three-roller mill is provided with 5 in. × 5 in. rollers of Meehanite cast iron, while the spur gears and casting which carries the adjustable top roller are of steel. This top roller is fitted with a compression spring while scrapers are provided for both bottom rollers Oilite bearings are fitted, and the juice tray and scrapers are removable for cleaning. The illustration shows a **ROLEX** mill belt-driven by a 3 h.p. electric motor.

The teeth of the well-known **CUTEX** laboratory cane shredder are cut from a solid piece of steel and are driven inside their housing, by an electric motor mounted on the same bed-plate and connected by a flexible coupling. For the illustration the coupling and shredder housings have been removed.





Our high-speed mixer for analysis of fibre in bagasse has knives of improved design with two speeds of 7000 and 14,000 r.p.m. and a special feeder-type lid to prevent spillage. Its metal goblet is of 2000 ml. capacity. It is provided with a motor designed to take only single-phase A.C.

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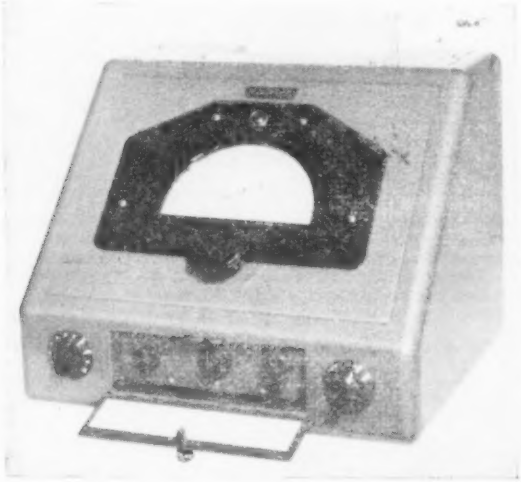
TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

The Kappa moisture meter Model AB/55. Kappa Electronics Division, Fidelity Cars Ltd., 159 Hammersmith Road, London, W.6.

The rapid and accurate determination of moisture content in a wide range of materials has been made possible by the introduction of the Kappa Model AB/55 Moisture Meter, a development of the earlier Kappa meter[1]. The instrument is a frequency-sensitive device that measures, in arbitrary units, the permittivity or dielectric constant of the contents of a removable test cell, the permittivity being dependent upon the physical properties and moisture content of the material. A change in frequency produced by a variation in the moisture content of the sample is accurately detected by a superheterodyne circuit and is indicated on a continuous scale that is calibrated in 1000 well-spaced divisions.



The frequency of the test circuit is selected so that readings are not affected by conductivity and a choice of cell size ensures that the sample is truly representative of the bulk. For normal materials of reasonably constant composition and texture, the accuracy can be expected to lie within 0·05–0·4 in the 0–20%; 0·2–0·5 in the 20–30%; 0·3–0·7 in the 30–40%; and 0·5–1·0 in the above 40% moisture range.

* * *

Flow-rate regulation. Brooks Instrument Company, Inc., Hatfield, Pa., U.S.A.

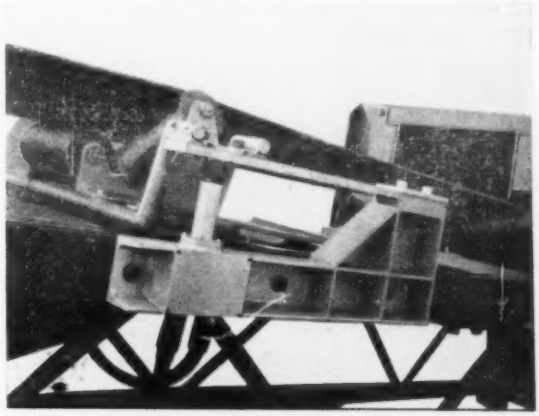
A new line of completely self-contained flow-rate controllers for purge and other flow control and indication applications is designated as Series 8800. A single unit includes the rotameter mounted on a needle-valve-operated flow controller. The controller has an internal diaphragm assembly designed to give a constant pressure differential for any valve setting. Because of the unit construction, all external piping has been eliminated. The Series 8800 controllers are much more compact than models previously available. Indication of diaphragm failure is positive. The integral rotameter instantly reflects diaphragm rupture or leakage.

The instruments are available in several sizes ranging in flow capacities from 0·01 g.p.h. (water) or 0·2 s.c.f.h. (air) to 12 g.p.m. or 48 s.c.f.m. Pressure rating depends on materials of construction: 250 p.s.i.g. for brass models; 500 p.s.i.g. for 316 stainless steel models. Diaphragms can be furnished in any of several material combinations, to permit user selection for optimum performance under particular temperature and corrosive conditions.

* * *

Continuous electronic belt weigher. Craven Electronics Limited, Victoria Works, Bingley, Yorks.

The Craven continuous electronic belt weigher automatically weighs and records the weight of material carried on a conveyor belt, presenting it on a counter in units of weight to suit any requirements. The unit is accurate to within 0·5% even with a badly loaded and out-of-track belt. Inaccuracies due to friction cannot arise as there are no wearing parts



in the weight section. The unit is easily fitted to belt conveyors of any make or type and occupies virtually no extra space on the conveyor. Headroom is not restricted and errors due to spillage are eliminated. All external circuits operate on low voltage and arrangements can readily be made for remote instrumentation. The equipment comprises three basic units:—

(1) A weighing section which includes two cantilever arms, positioned one on either side of the conveyor.

[1] *I.S.J.*, 1952, **54**, 52.

Any material on the conveyor belt deflects the arms proportionally to weight (normally about 0·050 in. for a fully loaded belt). This deflection is transmitted to the armatures of the Differential Transformers which produce a small alternating voltage, the amplitude of which varies linearly with the deflection i.e. with the weight of material on the conveyor belt.

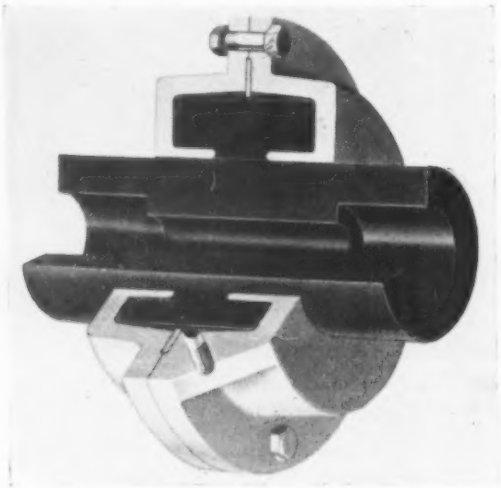
(2) The tachometer generator which produces the energizing current for the weighing transducers. It is driven from the underside of the top belt and the weight and belt speed are thus multiplied to produce a resultant flow rate signal.

(3) The integrating and totalizing unit, which includes an integrator motor which has a disc incorporated, which rotates at a speed directly proportional to the signal from the weigher and is therefore proportional to the instantaneous deflection of the weigh idler section and belt speed. The integrator motor produces pulses whenever the disc rotates, e.g. when material is passing over the conveyor. This is accomplished by means of light passing through holes in the disc, and striking a photo-electric cell. A given weight is therefore made to produce a definite number of pulses in a given time. A printing counter is actuated by the pulses from the integrator motor and records flow rate of material over the conveyor.

* * *

Round aperture valves. Neldco Processes Ltd., Crossway House, Bracknell, Berkshire.

A modified design of the Sala round aperture valve is now available in small sizes. The outer casing is of cast aluminium and closure is effected by hydraulic or pneumatic pressure on the rubber muscle. The inner liner of neoprene is, however, extended and



recessed to fit over a standard steel pipe and to be secured with hose clips. This type is now produced with 1 in, $\frac{1}{2}$ in and $\frac{1}{4}$ in bores and intermediate sizes can be supplied to order. The aperture remains completely round from full bore to closure and the valves are ideally suited for control of slimes.

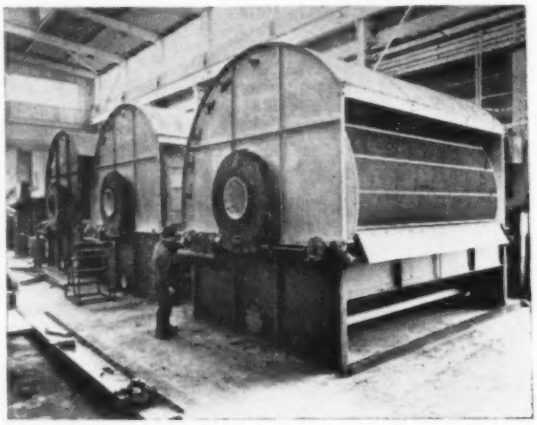
PUBLICATIONS RECEIVED

STOCK CHAIN DRIVES. Renold Chains Ltd., Wythenshawe, Manchester.

A new extension to the Renold range of chain drives is a series utilizing the 0·625-inch pitch simple roller chain which provides a step between the 0·5 and 0·75-inch pitch drives. Standard chaincases are available with four alternative modes of lubrication while 21 different ratios are provided. The drives may be run at pinion speed up to 2200 r.p.m., transmitting 16 h.p. at this speed.

* * *

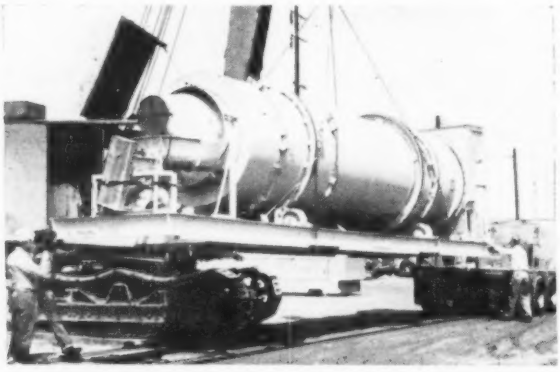
British filtration plant for U.S.S.R.—The first consignment of a filtration plant order totalling £140,000 is on its way to the U.S.S.R. to be installed in two beet sugar factories in the Ukraine. The manufacturer is Eimco (Great Britain) Ltd.



of Gateshead and the order is part of the £7$\frac{1}{2}$ million Vickers and Bookers Ltd. contract. Eimco is supplying eight rotary vacuum filters of 11 ft 6 in dia. × 14 ft face as illustrated and four 5-compartment tray thickeners (18 ft dia.) together with receivers, pumps, drives and other ancillary equipment.

* * *

Sugar dryer for Taiwan.—The Standard-Hersey sugar dryer illustrated is being loaded on a semi-trailer for transport to Los Angeles harbour, where it will be put on ship for the transpacific voyage to Taiwan. Standard Steel Corporation



of Los Angeles manufactured the dryer shown and a companion cooler under contract to the William Hunt Corporation of Taipei, Taiwan. Final destination of the equipment is the Ping Tung sugar mill of the Taiwan Sugar Corporation. Purchase of the equipment was financed by the International Cooperation Administration.

POWER PLANT

FROM STOCK

★ TWO 1800 kW geared pass-out/back pressure type STEAM TURBO ALTERNATOR SETS, each incorporating turbine by *Belliss & Morcom*, designed for steam at 155/195 p.s.i.g., 500/550 F. temperature, passing out 15,000 lb. of steam per hour at 15 p.s.i.g. and exhausting the remainder of the steam at a back pressure of 4/5 p.s.i.g. THESE SETS CAN OPERATE AS STRAIGHT BACK PRESSURE AT A LOAD OF 1150 KW WITH STEAM AT 150 P.S.I.G. 550 F. TEMPERATURE, EXHAUSTING AGAINST 10/15 LB. BACK PRESSURE.

Turbine direct coupled through gearbox ratio 6 : 1 to alternator by *Bruce Peebles*, wound for 3,300 volts 3 phase 50 cycles supply, having direct coupled exciter and switchgear.

★ 800 kW 400 volts 3 phase 50 cycles 4-wire back pressure type STEAM TURBO ALTERNATOR SET by the *English Electric Co.*, incorporating turbine designed to work with steam at 185 p.s.i.g., 620 F. temperature, exhausting against 25 lb. back pressure, speed 6000 r.p.m. Turbine direct coupled through gearbox to alternator, speed 1500 r.p.m., with exciter and switchgear.

★ 625 kW 400 volts 3 phase 50 cycles back pressure type STEAM TURBO ALTERNATOR SET incorporating turbine by *Belliss & Morcom*, designed to work with steam at 150 p.s.i.g., exhausting against 18 lb. back pressure, speed 4500 r.p.m. Direct coupled through *David Brown* gearbox to alternator by *Lancashire Dynamo & Crypto*, with exciter and switchgear.

★ THREE 600 kW 400 volts 3 phase 50 cycles 4-wire geared back pressure type STEAM TURBO ALTERNATOR SETS, each incorporating turbine by *G. & J. Weir*, designed to work with steam at 200 p.s.i.g., slightly superheated exhausting against 10 lb. back pressure. Direct coupled through gearbox ratio 4 : 1 to alternator by the *English Electric Co.*, 1000 r.p.m., with direct coupled exciter and switchgear.

★ TWO 500 kW STEAM ENGINE DRIVEN ALTERNATOR SETS, each incorporating *Belliss & Morcom* vertical compound engine, rated to develop 720 h.p. when supplied with steam at 150 p.s.i.g., exhausting against 15 lb. back pressure. Direct coupled at 300 r.p.m. to alternator by the *Electric Construction Co.* at present wound for 6,600 volts, but can be reconnected for 3,300 volts or rewound for 400 volts 3 phase 50 cycles supply; with direct coupled exciter and switchgear.

★ 300 kW 400 volts 3 phase 50 cycles STEAM ENGINE DRIVEN ALTERNATOR SET incorporating *Belliss & Morcom* compound engine, rated to develop 430 h.p. continuously when running at 375 r.p.m. and when supplied with dry saturated steam at 120 p.s.i.g., exhausting against 10 lb. back pressure. Direct coupled to alternator by *Crompton Parkinson*, with direct coupled exciter and switchgear.

★ 562 kVA DIESEL ENGINE DRIVEN ALTERNATOR SET incorporating 660 h.p. vertical 6-cylinder 4-stroke cycle engine by *Mirrlees, Bickerton & Day*, type HFB.6. Direct coupled at 375 r.p.m. to alternator by *British Thomson Houston*, at present wound for 6,600 volts, but we can provide a transformer or rewind for 400/440 volts 3 phase 50 cycles supply; revolving field machine with direct coupled exciter and switchgear.

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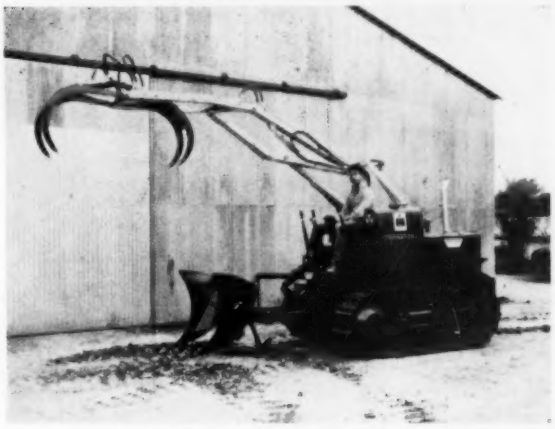
SUGAR CANE LOADERS



Broussard patented "Flex-Boom" Loader mounted on an International BTD-8 tractor, with push piler for Trinidad.

Capacity 2000 lb minute (Under Louisiana conditions), grab capacity (54 in. opening) 1500 lb., load clearance 12 ft., loading radius 10 ft. to 12 ft., boom swing, front to right, 100°.
The Broussard heavy duty tropical type loader is also available for installation on the Caterpillar D-4, Track-Marshall, International TD-9, Allis-Chalmers HD-6, John Deere 440 crawler, Fordson-Major and International B 450 as well as various USA wheel tractors.
Extremely simple in design with few wearing parts and with perfect operator visibility on both wheel and crawler tractor installations, the Broussard Loader may be easily installed at the destination on tractors already in hand and quickly removed at the close of the harvest.

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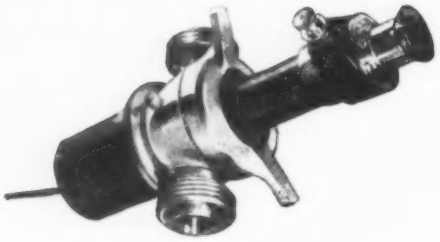

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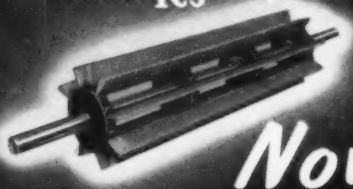

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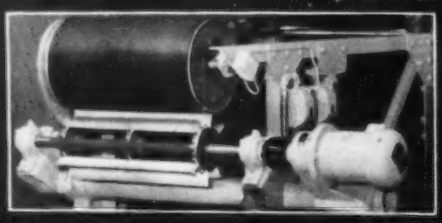

Showing the Unit in position ready for action. Micro-adjustable. Flameproof. Anti-static features can be incorporated. Little, if any, guarding required.

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THE Kleen-e-ze BRUSH CO. LTD

83 BEVAN LANE, HANHAM, BRISTOL

Hong Kong Sugar Imports and Exports[1]

IMPORTS	*metric tons*	
Raw Sugar:	1959	1960
Australia	22,586	39,836
Cambodia	0	10
Cuba	10,083	0
Dominican Republic	0	18,370
Fiji	2,092	14,250
Indonesia	1,524	3,353
Japan	500	0
Mauritius	8,749	0
Philippines	4,568	4,280
Taiwan	2,135	1,257
Thailand	0	189
Total Raw Sugar	52,237	81,545
Refined Sugar:		
Burma	1,014	0
Cambodia	71	20
China	9,332	8,683
Cuba	0	508
Czechoslovakia	300	0
Germany	0	200
Indonesia	0	1,636
Japan	5,945	9,739
Malaya	0	711
Philippines	686	1,332
South Africa	0	1,067
Taiwan	19,329	17,531
Thailand	0	11
United kingdom	0	1
Total Refined Sugar	36,677	41,439
Total Imports (Raw Value)	92,103	126,588
EXPORTS & RE-EXPORTS		
Refined Sugar:		
Aden	133	155
Australia	83	298
British East Africa	382	489
British North Borneo	1,989	1,321
Cambodia	509	4,521
Canada	0	234
China	563	0
Ghana	30	0
India	61	49
Japan	0	96
Laos	1,082	362
Macao	1,815	1,626
Malaya	40,440	41,762
Nigeria	52	14
Oceania (excluding U.S. Oceania)	73	718
Thailand	71	7
U.S.A. (including U.S. Oceania)	895	1,144
Other countries	139	143
Total Refined Sugar	48,317	52,939
Raw Sugar:		
Macao	9	8
Malaya	1,871	421
U.S. Oceania	0	100
Total Raw Sugar	1,880	529
Grand Total (Raw value)	54,399	58,072

BREVITIES

New South African sugar refinery. It is reported[2] that Natal Estates Ltd. has built a new refinery near Mount Edgecombe, Natal, with a production capacity of 30 tons per hour.

* * *

Palm sugar refinery for Cambodia[3].—Complete equipment for a palm sugar refinery is to be supplied by Czechoslovakia to Cambodia. This plant will be the first one of its kind in the world.

* * *

Tanganyika sugar production 1960/61[4].—In the 1960/61 season which ended on the 15th April Tanganyika Planting Co. Ltd. produced 25,008 long tons of sugar compared with 23,691 tons in 1959/60. This is the highest achieved since the Company started operations in 1936. The estimate for the 1961/62 season is 28,000 tons.

* * *

Ceylon sugar factory closures[5].—The two sugar factories opened in Ceylon last year had to close down after a short while owing to inadequate supplies of cane and a shortage of technical staff. It was planned that initially 80,000 tons of cane would be made available, but it has been reported that only 20,000 tons were produced last year.

* * *

Verenigde H.V.A.-Maatschappijen N.V. 1960 Report.—No information is available on the Indonesian estates of N.V. Handelsvereeniging "Amsterdam." The production of the Wonji sugar estate in Ethiopia was 39,857 tons compared with 35,858 tons in 1958/59. Erection of the new Shoa factory is continuing according to plan and it should come into operation in October 1962.

* * *

New Florida sugar mill.—Farrel-Birmingham Co. Inc., of Ansonia, Conn., U.S.A., has been awarded a contract by the Sugar Cane Growers' Cooperative of Florida to build a complete raw sugar factory in Belle Glade, Florida. The new mill, to be known as the Glades Sugar House, will be constructed just north of Belle Glade on the shore of Lake Okeechobee, twelve miles from the Bryant Sugar House which is already being constructed by Farrel-Birmingham for the United States Sugar Corp. The Glades Sugar House will have a capacity of 5000 tons daily over a minimum of 150 days of harvesting. More than 1000 workers will be employed in the plant and fields and it involves an investment of more than $13,000,000, of which $11,000,000 has been allocated to the sugar house construction and the remainder for agricultural development in the fields. The order received by Farrel covers the manufacture of the cane crushing equipment and also the Company's responsibility as prime contractor in the procurement and construction of the factory. The 84-inch milling tandem will have individual turbine drive on each unit and will be equipped with two Farrel K-4 knife sets, rubber belt intermediate carriers, completely enclosed gearing and air clutches on each carrier and in the drive. Associated with Farrel-Birmingham on the project, as in the construction of the Bryant plant, will be Farrel's representative in Puerto Rico, Sucesores de Abarca, which is also supplying certain of the sugar processing equipment. Preliminary work has begun on the site and the mill is expected to be completed before December 1962, when the first milling season will begin. Preparations for planting of the sugar cane to be processed are also under way. A minimum of 20,000 acres will be planted, which will be enough to keep the plant running at full capacity.

[1] *I.S.C. Stat. Bull.*, 1961, **20**, (7), 43–44.
[2] F. O. Licht, *International Sugar Report*, 1961, **93**, (6), 107.
[3] F. O. Licht, *International Sugar Report*, 1961, **93**, (Supp. 10), 133.
[4] *Overseas Review* (Barclays D.C.O.), June 1961, 35.
[5] C. Czarnikow Ltd., *Sugar Review*, 1961, (512), 110.

BREVITIES

Bagasse paper in India[1].—The Government of India have licensed a number of new large-sized paper units apart from substantial expansion of the existing paper industry to achieve the target of paper production laid down in the Third Five-Year Plan. Eighteen new units are to be built—5 in U.P., 4 in Bihar, 3 in Madhya Pradesh, 2 in Mysore and 1 each in Orissa, Assam, Maharashtra and Punjab. They are expected to consume a total of 632,000 tons of bagasse. In addition, expansion of existing capacity has been allowed in eight other units. In view of the limited availability of bamboo, many of the licences granted are based on the use of bagasse as raw material.

* * *

The late Dr. M. Drachovská. The death is announced of Dr. M. Drachovská-Simanová, who was Director of the Biology Department of the Sugar Research Institute in Czechoslovakia and lecturer at the Prague University of Chemical Technology. Born in 1918, Dr. Drachovská studied agricultural and forestry engineering, receiving her doctorate in 1946 and joined the Sugar Research Institute in 1949. Her studies on the effects of virus and fungal diseases on the technical value of the sugar beet culminated in a monograph "Beet viruses" and she was also the author of numerous books and articles on beet physiology and other sugar subjects, sometimes in collaboration with the late Dr. Sandera and other workers. She received a Doctorate of Natural Sciences in 1950.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 17th August*, 1961)	
Anglo-Ceylon (5s)	13/–
Antigua Sugar Factory (£1)	7/6
Booker Bros. (10s)	23/3
British Sugar Corp. Ltd. (£1)	25/–
Caroni Ord. (2s)	4/1½
Caroni 6% Cum. Pref. (£1)	12/6
Distillers Co. Ltd. (10s units)	36/6
Gledhow Chaka's Kraal (£1)	22/6
Hulett & Sons (R1)	8/9
Jamaica Sugar Estates Ltd. (5s units)	4/–
Leach's Argentine (10s units)	25/9
Manbré & Garton Ltd. (10s)	42/3
Reynolds Bros. (£1)	28/9
St. Kitts (London) Ltd. (£1)	17/–
Ste. Madeleine (Ord.) (£1)	28/–
Sena Sugar Estates Ltd. (10s)	9/–
Tate & Lyle Ltd. (£1)	49/6
Tate & Lyle Investments Ltd. (5s)	15/1½
Trinidad Sugar (5s stock units)	38/9
United Molasses (10s stock units)	31/9
West Indies Sugar Co. Ltd. (£1)	14/9

CLOSING MIDDLE

New York Stocks (*at 16th August*, 1961)	$
American Crystal ($10)	51⅜
Amer. Sugar Ref. Co. ($25)	32¼
Central Aguirre ($5)	25½
Cuban American ($10)	15¾
Great Western Sugar Co.	35⅛
South P.R. Sugar Co.	22¾
United Fruit Co.	26½

Erratum.—In line 35 of column 2 on page 178 of our June issue, the sugar fucose was incorrectly given as fructose.

* * *

Mr. J. Eisner.—Following his retirement as Technical Adviser to Booker Bros. McConnell & Co. Ltd., who have retained his services as a consultant, however, Mr. J. Eisner of our Panel of Referees has set up an independent practice as Sugar Technology Consultant from his home address: Colentina, Bishops Walk, Addington, Croydon, Surrey.

* * *

Syrian sugar expansion[2].—Great efforts are being made to extend the Syrian sugar industry. The capacity of the sugar factory and refinery at Homs which now is 1250 tons of beet and 200 tons of white sugar per day is to be doubled, the necessary equipment to be supplied by Technoexport of Czechoslovakia. In addition to the existing factories at Homs and Damascus, three further plants are to be built near Jisr-Ech-Choghour, near Rakka and near Deir Ez-Zor.

* * *

New factory in Jamaica[3].—Mr. Victor de Maria, President of the Kelvin Engineering Corp. of New York, who recently visited Jamaica in connexion with plans for the erection of a new sugar factory in Hanover[4], said before leaving that if matters progressed satisfactorily the ground breaking ceremony could take place in the autumn. It is hoped to have the factory in operation to handle the 1962/63 crop. The proposed mill would be capable of handling about 240,000 tons of cane and would turn out a considerably higher production of sugar than the existing factories in the island. The diffuser technique would be used for the first time in Jamaica.

* * *

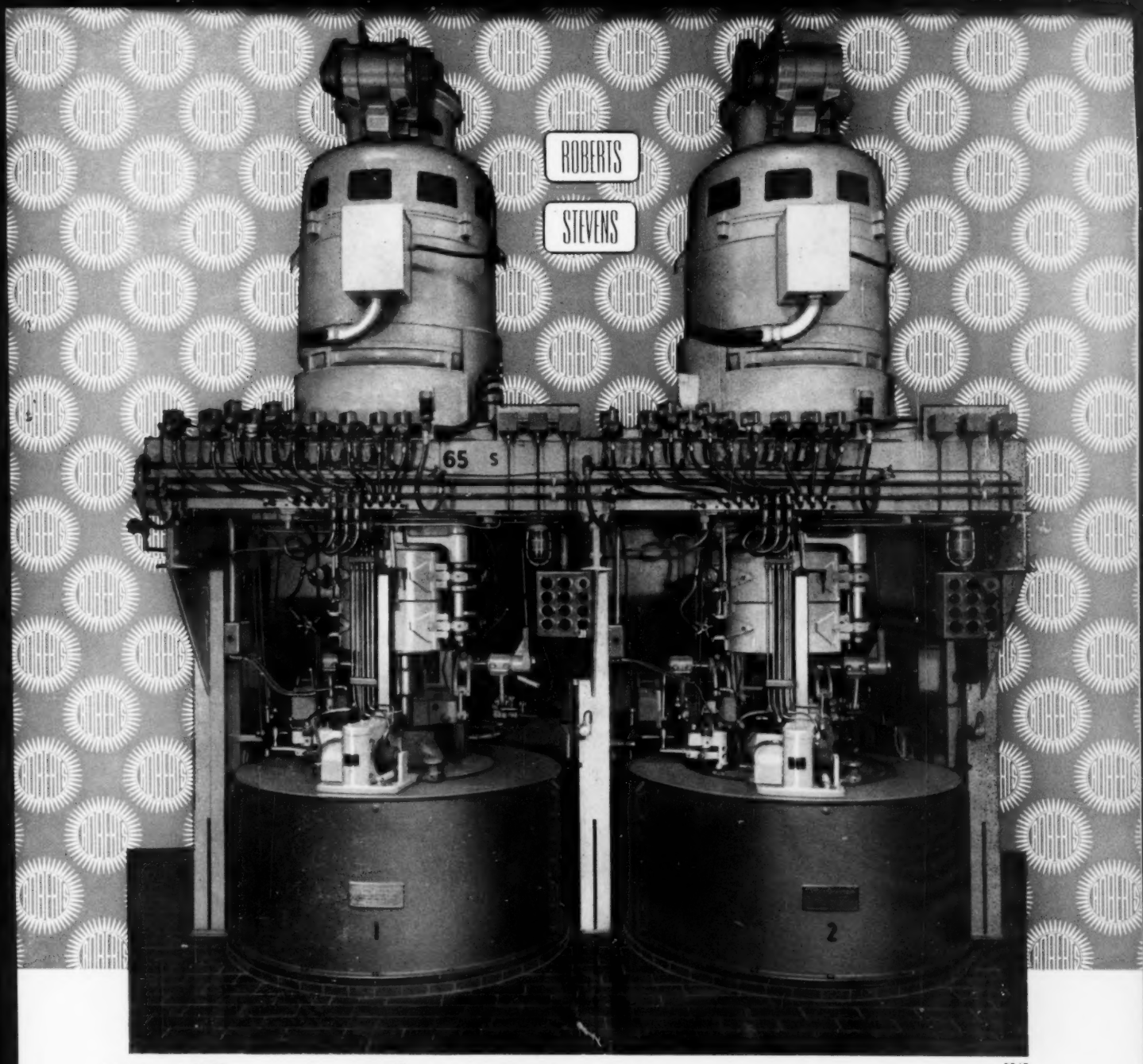
Argentina sugar industry difficulties[5].—Harvesting and processing of the sugar crop began at the end of June instead of early in May. The delay was due to a dispute between growers and millers over the payment for the outstanding balance of the 1959 and 1960 crops. The mills maintained that they were already indebted to the Banco de la Nación for 3,000,000,000 pesos and that they lacked the funds to meet their obligations. The Banco de la Nación agreed to grant loans to the mills to enable them to pay growers for the 1959 and 1960 crops and to advance funds against the 1961 crop. A law promulgated in Tucumán on the 7th July declares the sugar industry of the Province to be of public interest and authorizes the Government of the Province to expropriate or intervene in the management of the sugar mills.

* * *

Cuban sugar production, 1961[6].—Final production figures for the 1961 crop, as given by the National Institute for Agrarian Reform, are as follows, compared with final outturn in the last crop:

	Sugar (*Spanish tons*)	*Molasses* (*Gallons*)
Pinar del Río	241,694	12,782,356
Habana	495,445	26,988,705
Matanzas	747,289	38,986,708
Las Villas	1,354,400	63,462,476
Camagüey	1,742,639	90,047,607
Oriente	1,985,919	87,798,869
Total	6,567,386	320,066,721
1960	5,688,859	287,371,395

[1] *Indian Sugar*, 1961, **11**, 91.
[2] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (5), 84.
[3] *Commonwealth Producer*, 1961, (984), 152.
[4] *I.S.J.*, 1961, **63**, 192.
[5] *Fortnightly Review* (Bank of London & S. America Ltd.), 1961, **26**, 749.
[6] *Willett & Gray*, 1961, **85**, 300.



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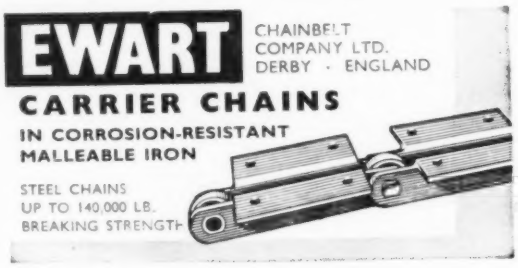

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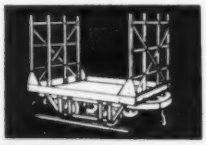

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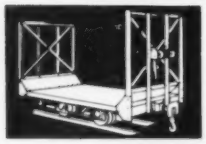

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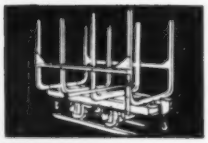

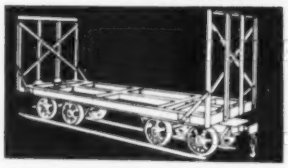

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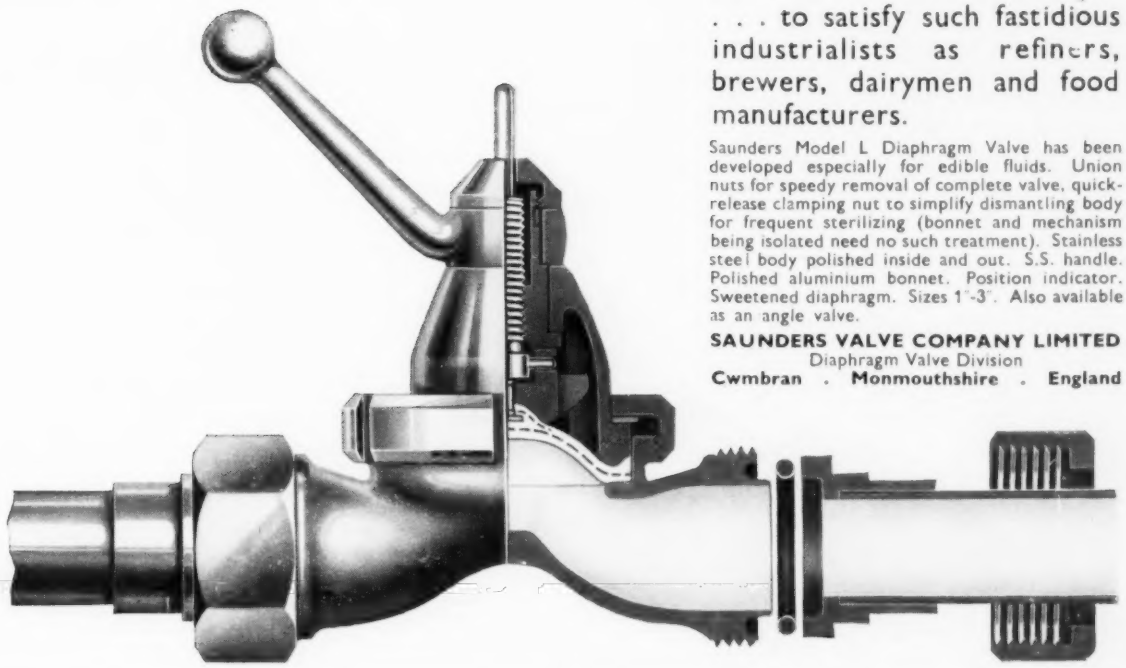

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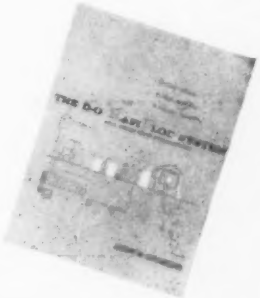

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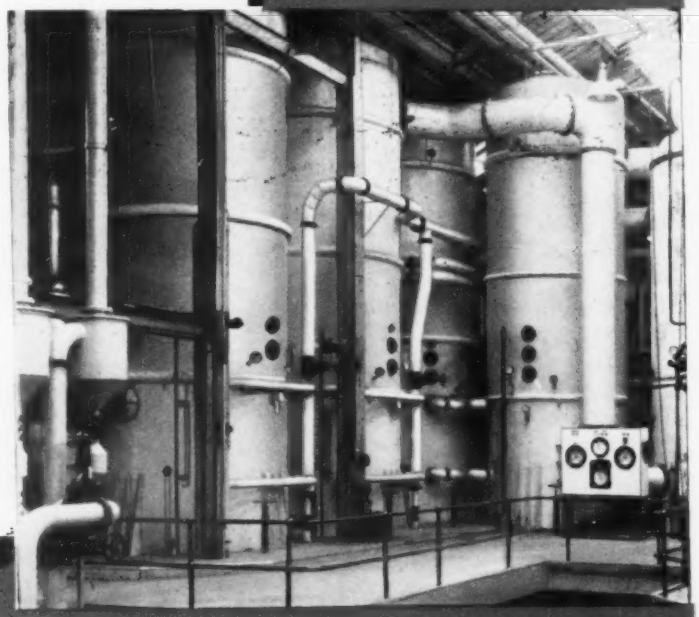

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Printed by JOHN ROBERTS & SONS, Salford, Manchester; and published by the Proprietors, THE INTERNATIONAL SUGAR JOURNAL LTD., at Central Chambers, The Broadway, London, W.5. Entered at the New York Post Office as Second-Class Matter. Registered for transmission by Canadian Magazine Post.

PRINTED IN GREAT BRITAIN.